



**Source Emissions Testing Report  
Becton Dickinson Medical**

**Ethylene Oxide Sterilization Chamber  
Catalytic Oxidizer**

**Columbus, Nebraska**

Test Date: July 31, 2015

Report prepared for:  
BD Medical – Pharmaceutical Systems  
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## Certification

### Team Leader Certification:

I certify that all of the sampling and analytical procedures and data presented in this report are authentic and accurate.

A handwritten signature in black ink, appearing to read "Josh".

Josh Hinchberger  
Field Team Leader / Project Manager

### Reviewer Certification:

I certify that all of the testing details and conclusions are accurate and valid.

A handwritten signature in black ink, appearing to read "Marty".

Marty Willinger  
Reviewer / Technical Writer



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Test Report – BD Medical  
Columbus, Nebraska – Ethylene Oxide DRE  
APT Project BDM5121

## 1. Introduction

Air Pollution Testing, Inc (APT) was contracted by Becton-Dickinson Medical (BD Medical) for emission testing services at the BD Medical facility located in Columbus, Nebraska.

The purpose of the emissions testing program was to quantify the concentrations and mass flow rates of ethylene oxide into and out of the ethylene oxide sterilization chamber to determine the ethylene oxide destruction removal efficiency (DRE).

The testing was conducted to satisfy applicable requirements imposed by the United States Environmental Protection Agency (EPA) and the Nebraska Department of Environmental Quality (NDEQ). The facility is subject to the emission limits and testing requirements provided in *40 CFR Part 63 National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart O – Ethylene Oxide Emissions Standards for Sterilization Facilities*. The unit is required to demonstrate 99% DRE.

Table 1.1 provides key project personnel, company affiliations and contact information. Source identification and operating standards are summarized in Table 1.2.

BD Medical – Columbus, Nebraska Ethylene Oxide Catalytic Oxidizer Testing Program Contact Personnel		
Name, Title	Company Address	Phone, Fax, Email
Ms. Sharon Huey, Environmental/Safety Engineer	BD Medical 920 East 19 <sup>th</sup> Street Columbus, Nebraska 68601	402-835-1409, 402-563-8596 fax <a href="mailto:sharon_huey@bd.com">sharon_huey@bd.com</a>
Mr. Brad Pracheil, Compliance Specialist	NDEQ 1200 "N" Street, Suite 400 P.O. Box 98922 Lincoln, Nebraska, 68509-8922	402-471-4141, 402-471-2909 fax <a href="mailto:brad.pracheil@nebraska.gov">brad.pracheil@nebraska.gov</a>
Mr. David Maiers, Director of Operations	Air Pollution Testing, Inc. 5530 Marshall Street Arvada, Colorado 80002	303-420-5949 x 33, 303-420-5920 fax <a href="mailto:dmaiers@airtest.net">dmaiers@airtest.net</a>

**Table 1.1: Testing Program Contact Personnel**

<b>BD Medical – Columbus, Nebraska Ethylene Oxide Catalytic Oxidizer Source Identification Summary</b>	
<i>Source Identification</i>	<i>Standards and Operating Limits</i>
Catalytic Oxidizer	Ethylene Oxide DRE $\geq$ 99% Catalyst bed outlet temperature to be recorded

**Table 1.2: Source Identification Summary**

## 2. Test Results Summary

The results of the testing program are summarized in Table 2.1 on the following page. Any emission parameters not presented in the table may be found in *Appendix 1*. The following terms are used in the table:

- temp °F – degrees Fahrenheit
- %vd – diluent concentration, dry volume percent
- %vw – stack gas moisture content, wet volume percent
- dscfm – stack gas flow rate, dry standard (one atm., 68 °F) cubic feet per minute
- lb/hr – pollutant mass emission rate, pounds per hour
- ppmvd – pollutant concentration, parts per million dry volume basis
- DRE – destruction removal efficiency
- C<sub>2</sub>H<sub>4</sub>O – ethylene oxide

Test Report – BD Medical  
Columbus, Nebraska – Ethylene Oxide DRE  
APT Project BDM5121

BD Medical – Columbus, Nebraska Ethylene Oxide Catalytic Oxidizer: Test Results (July 31, 2015)					
	Run #1	Run #2	Run #3	Average	Permitted Limits
Start Time	9:30	10:38	12:27		
Stop Time	10:30	11:38	13:12		
<b><u>Inlet Data</u></b>					
O <sub>2</sub> (%vd)	20.9	20.9	20.9	20.9	
CO <sub>2</sub> (%vd)	0.0	0.0	0.0	0.0	
H <sub>2</sub> O (%vw)	3.8	3.1	4.0	3.6	
Stack Temp (°F)	97	101	104	101	
Gas Flow (dscfm)	4,292	4,234	4,331	4,286	
C <sub>2</sub> H <sub>4</sub> O (ppmvd)	2249.59	2224.40	2101.11	2191.70	
C <sub>2</sub> H <sub>4</sub> O (lb/hr)	66.18	64.55	62.38	64.37	
<b><u>Outlet Emissions Data</u></b>					
O <sub>2</sub> (%vd)	20.9	20.9	20.9	20.9	
CO <sub>2</sub> (%vd)	0.0	0.0	0.0	0.0	
H <sub>2</sub> O (%vw)	3.8	3.1	4.0	3.6	
Stack Temp (°F)	183	190	183	185	
Gas Flow (dscfm)	4,592	4,403	4,522	4,505	
Catalyst Temp (°F)	176	189	172	179	
C <sub>2</sub> H <sub>4</sub> O (ppmvd)	0.16	0.23	0.19	0.19	
C <sub>2</sub> H <sub>4</sub> O (lb/hr)	0.005	0.007	0.006	0.006	
<b><u>DRE</u></b>					
C <sub>2</sub> H <sub>4</sub> O DRE (%)	99.99%	99.99%	99.99%	99.99%	99.0

**Table 2.1: Ethylene Oxide Catalytic Oxidizer Test Results**

### 3. Methods

#### 3.1. Test Methods

APT tested in accordance with the following U.S. Environmental Protection Agency (EPA) source emission test methods referenced in 40 CFR Part 60, Appendix A.

- *Method 1 – Sample and Velocity Traverses for Stationary Sources*
- *Method 2 – Determination of Stack Gas Velocity and Volumetric Flow Rate*
- *Method 3 – Gas Analysis for the Determination of Dry Molecular Weight*
- *Method 4 – Determination of Moisture Content in Stack Gases*
- *Method 18 – Measurement of Gaseous Organic Compound Emissions by Gas Chromatography*

#### 3.2. Method Deviations

At the inlet sampling location, APT did not conduct EPA Method 4 sampling for moisture determination. Moisture determination at the inlet sampling location poses significant ethylene oxide exposure risks. Previous testing at this facility and on identical ethylene oxide sterilization chambers indicate moisture values to be close to ambient conditions for both the inlet and outlet sampling locations. Moisture content was determined from the outlet sampling location only and used for both the inlet and outlet volumetric flow calculations.

### 4. Test Program Summary

Three (3), performance test runs were conducted to determine the concentrations of ethylene oxide into and out of the sterilization chamber. The third run was 45-minutes in duration due to an excursion in catalyst temperature prior to the run.

During each test run, concurrent volumetric flow measurements were conducted at the inlet and outlet sampling locations to allow for the calculation of mass emissions. Moisture content was determined from the outlet sampling location only and used for both the inlet and outlet volumetric flow calculations. Since the stack gas content is essentially air, a dry molecular weight of 29.0 was assumed. DRE was determined by comparing the inlet and outlet ethylene oxide values on a mass flow basis.

Previous testing at this facility indicated lower than expected inlet ethylene oxide levels, necessitating very low detection limits at the outlet to demonstrate 99% control. The test used direct-interface EPA Method 18 on-site gas chromatographs equipped with flame ionization detectors (GCFID) to determine the inlet and outlet levels of ethylene oxide. The GCFID was calibrated with ethylene oxide balanced nitrogen standards certified to 2% accuracy or dilutions of certified standards.

The test program determined all of the parameters detailed in Table 4.1. During the test program, the catalyst bed outlet temperature was monitored by BD Medical personnel and can be found in *Appendix 5*.

BD Medical – Columbus, Nebraska Ethylene Oxide Catalytic Oxidizer Testing Program Sampling and Analytical Methods Summary			
Gas Parameter	Sampling Method	Analytical Method	Laboratory
gas flow rate	Methods 1, 2	thermocouple, pitot tube and draft gauge	APT, on-site
O <sub>2</sub> , CO <sub>2</sub>	Method 2	assumed ambient	
H <sub>2</sub> O (outlet only)	Method 4	gravimetric	
Ethylene oxide	Method 18	gas chromatograph with flame ionization detector	

**Table 4.1: Sampling and Analytical Methods Summary**

## 5. Test Method Details

### 5.1. Stack Gas Flow, Diluent, and Moisture Content

Stack gas velocity, volumetric flow rate, diluent (O<sub>2</sub> and CO<sub>2</sub>), and moisture (H<sub>2</sub>O) content were measured in accordance with EPA Methods 1, 2 and 4.

Each sampling period consisted of conducting a temperature and differential pressure traverse of each sampling location using a K-type thermocouple and an S-type pitot tube. Concurrent with each traverse, a sample of gas for moisture determination was extracted from the stack at a constant flow rate of no more than 0.75 cubic feet per minute (cfm). The gas sample passed through a stainless steel probe, through a series of four (4) chilled glass impingers, and through a calibrated dry gas meter. Please see *Appendix 4 –Schematics* for a drawing of the EPA Methods 1, 2 and 4 sampling train.

Prior to sampling, the first two impingers were each seeded with 100 milliliters of water. The third impinger was empty. The fourth impinger was seeded with 250 grams of dried silica gel. Following sampling, the moisture gain in the impingers was measured gravimetrically to determine the moisture content of the stack gas.

Since the stack gas content is essentially air, a dry molecular weight of 29.0 was assumed.

The temperature and differential pressure traverse data were combined with diluent measurements to calculate the stack gas velocity and volumetric flow rate in units of feet per second (ft/sec), actual cubic feet per minute (acf m), dry standard cubic feet per minute (dscfm), and pounds per hour (lb/hr).

## 5.2. Ethylene Oxide

Ethylene oxide levels were determined in accordance with EPA Method 18 using the direct interface sampling and analysis procedures detailed in the method. Samples were analyzed on-site with two HP Model 5890 Series II Gas Chromatographs (GC) equipped with a flame ionization detector (FID) and Chemstation software.

Using a heated sample probe/line, stack gas was transported directly to the gas sampling valve of each GC. Samples were analyzed approximately once each 10 minutes. A “test run” consisted of five (5) consecutive injections. Three test runs were conducted (for a total of 15 injections) at the inlet and outlet of the catalytic oxidizer.

Prior to sampling, gas phase calibration standards were prepared by dilution of a +/-2% accuracy certified gas standard. Preparation of diluted standards was conducted using a gas-tight volumetric syringe and new Tedlar bags. Triplicate (minimum, more if required to meet the 5% agreement limit) injections were conducted for each standard, and a calibration curve of peak area versus concentration was prepared. A least squares line ( $y=mx$ ) was fit to each data set. A line loss test was conducted to ensure adequate sampling system performance.

Following analysis of stack gas samples, the mid-level calibration standard was re-analyzed at the gas sampling valve in triplicate. Because the average of the initial calibration response (triplicate average) and the post-test check response (triplicate average) were within 5% of their mean value, the initial calibration linear regression data were used to quantify the emission levels for each GC.

The results of the GC analysis were used to calculate ethylene oxide levels in units of parts per million, wet volume basis (ppmvw). The data were combined with stack gas volumetric flow rate data to calculate emissions in units of pounds per hour (lb/hr). Catalytic oxidizer DRE was calculated on a mass basis.

## **6. Conclusions**

The testing conducted by APT on the ethylene oxide catalytic oxidizer at the BD Medical facility in Columbus, Nebraska on July 31, 2015 demonstrates that the unit is operating in compliance with the emission limits imposed by the EPA and the NDEQ.



## Appendix One: Testing Parameters / Sample Calculations

**BD Medical**  
**Columbus, Nebraska**  
**Ethylene Oxide Sterilization Chamber**  
**Catalytic Oxidizer - Inlet**  
**7/31/2015**

Field Reference Method Data (Inlet)					
	Run #	1	2	3	Average
	Start Time	9:30	10:38	12:27	
	Stop Time	10:30	11:38	13:12	
	Sample Time	60	60	45	
hrs	Hours of Operation / Year	8,760	8,760	8,760	8,760
D <sub>S</sub>	Stack Diameter (inches)	23.50	23.50	23.50	23.50
ΔP <sub>AVG</sub>	(Delta P) <sup>1/2</sup>	0.4668	0.4592	0.4750	0.4670
C <sub>P</sub>	Pitot Tube Constant (unitless)	0.838	0.838	0.838	0.838
T <sub>S</sub>	Stack Temp (°F)	97	101	104	101
P <sub>bar</sub>	Barometric Press (mbar)	960	960	960	960
P <sub>bar</sub>	Barometric Press ("Hg)	28.35	28.35	28.35	28.35
P <sub>s</sub>	Stack Pressure ("H <sub>2</sub> O)	-8.80	-8.80	-8.80	-8.80
Y <sub>d</sub>	Meter Y Factor (unitless)	1.008	1.008	1.008	1.008
T <sub>m</sub>	Meter Temperature (°F)	84	94	98	92
V <sub>m</sub>	Sample Volume (ft <sup>3</sup> )	37.983	37.864	34.483	36.777
ΔH	Delta H ("H <sub>2</sub> O)	1.0	1.0	1.5	1.2
V <sub>lc</sub>	Moisture (grams)	29.6	23.5	27.6	26.9
O <sub>2</sub> %vd	O <sub>2</sub> (%vd)	20.9	20.9	20.9	20.9
CO <sub>2</sub> %vd	CO <sub>2</sub> (%vd)	0.0	0.0	0.0	0.0
N <sub>2</sub> %vd	N <sub>2</sub> (%vd)	79.1	79.1	79.1	79.1

Method 18 GC Data (Inlet)					
MW	Run #	1	2	3	Average
44.05	Ethylene Oxide (ppmvw)	2164.11	2155.42	2021.27	2113.60

Reference Method Calculations (Inlet)					
	Run #	1	2	3	Average
V <sub>mstd</sub>	Sample Volume (dscf)	35.273	34.567	31.262	33.701
V <sub>wstd</sub>	Moisture Volume (scf)	1.39	1.11	1.30	1.27
B <sub>ws</sub>	Moisture Content (%/100)	0.038	0.031	0.040	0.036
M <sub>D</sub>	Molecular Weight Dry	28.84	28.84	28.84	28.84
M <sub>A</sub>	Molecular Weight Wet	28.42	28.50	28.40	28.443
V <sub>S</sub>	Gas Velocity (ft/sec)	28.1	27.7	28.8	28.22
F <sub>ACFM</sub>	Gas Flow (acf m <sup>3</sup> /hr)	5,083	5,009	5,208	5,100
F <sub>DSCFM</sub>	Gas Flow (dscfm)	4,292	4,234	4,331	4,286
lb/hr	Gas Flow (lb/hr)	19,748	19,390	19,954	19,698
	Ethylene Oxide (ppmvd)	2249.6	2224.4	2101.1	2191.7
	Ethylene Oxide (lb/hr)	66.18	64.55	62.38	64.37
	Ethylene Oxide (tpy)	289.87	282.72	273.22	281.94

DRE Calculations					
	Run #	1	2	3	Average
dry	Inlet C <sub>2</sub> H <sub>4</sub> O (ppmvd)	2249.59	2224.40	2101.11	2191.70
lb/hr	Inlet C <sub>2</sub> H <sub>4</sub> O (lb/hr)	66.18	64.55	62.38	64.37
dry	Outlet C <sub>2</sub> H <sub>4</sub> O (ppmvd)	0.16	0.23	0.19	0.19
lb/hr	Outlet C <sub>2</sub> H <sub>4</sub> O (lb/hr)	0.005	0.007	0.006	0.006
Eff %	Control Eff % C <sub>2</sub> H <sub>4</sub> O (ppmvd)	99.99%	99.99%	99.99%	99.99%
DRE	%DRE C <sub>2</sub> H <sub>4</sub> O (lb/hr)	99.99%	99.99%	99.99%	99.99%

**BD Medical**  
**Columbus, Nebraska**  
**Ethylene Oxide Sterilization Chamber**  
**Catalytic Oxidizer - Outlet**  
**7/31/2015**

Field Reference Method Data (Outlet)					
	Run #	1	2	3	Average
	Start Time	9:30	10:38	12:27	
	Stop Time	10:30	11:38	13:12	
	Sample Time	60	60	45	
hrs	Hours of Operation / Year	8,760	8,760	8,760	8,760
D <sub>S</sub>	Stack Diameter (inches)	23.25	23.25	23.25	23.25
ΔP <sub>AVG</sub>	(Delta P) <sup>1/2</sup>	0.5436	0.5207	0.5360	0.5334
C <sub>P</sub>	Pitot Tube Constant (unitless)	0.838	0.838	0.838	0.838
T <sub>S</sub>	Stack Temp (°F)	183	190	183	185
P <sub>bar</sub>	Barometric Press (mbar)	960	960	960	960
P <sub>bar</sub>	Barometric Press ("Hg)	28.35	28.35	28.35	28.35
P <sub>s</sub>	Stack Pressure ("H <sub>2</sub> O)	-0.20	-0.20	-0.20	-0.20
Y <sub>d</sub>	Meter Y Factor (unitless)	1.008	1.008	1.008	1.008
T <sub>m</sub>	Meter Temperature (°F)	84	94	98	92
V <sub>m</sub>	Sample Volume (ft <sup>3</sup> )	37.983	37.864	34.483	36.777
ΔH	Delta H ("H <sub>2</sub> O)	1.0	1.0	1.5	1.2
V <sub>lc</sub>	Moisture (grams)	29.6	23.5	27.6	26.9
O <sub>2</sub> %vd	O <sub>2</sub> (%vd)	20.9	20.9	20.9	20.9
CO <sub>2</sub> %vd	CO <sub>2</sub> (%vd)	0.0	0.0	0.0	0.0
N <sub>2</sub> %vd	N <sub>2</sub> (%vd)	79.1	79.1	79.1	79.1

Method 18 GC Data (Outlet)					
MW	Run #	1	2	3	Average
44.05	Ethylene Oxide (ppmvw)	0.16	0.22	0.18	0.19

Reference Method Calculations (Outlet)					
	Run #	1	2	3	Average
V <sub>mstd</sub>	Sample Volume (dscf)	35.273	34.567	31.262	33.701
V <sub>wstd</sub>	Moisture Volume (scf)	1.39	1.11	1.30	1.27
B <sub>ws</sub>	Moisture Content (%/100)	0.038	0.031	0.040	0.036
M <sub>D</sub>	Molecular Weight Dry	29.00	29.00	29.00	29.00
M <sub>A</sub>	Molecular Weight Wet	28.58	28.66	28.56	28.601
V <sub>S</sub>	Gas Velocity (ft/sec)	34.7	33.4	34.2	34.09
F <sub>ACFM</sub>	Gas Flow (acf m)	6,139	5,902	6,054	6,031
F <sub>DSCFM</sub>	Gas Flow (dscfm)	4,592	4,403	4,522	4,505
lb/hr	Gas Flow (lb/hr)	21,246	20,276	20,945	20,822
	Ethylene Oxide (ppmvd)	0.16	0.23	0.19	0.19
	Ethylene Oxide (lb/hr)	0.005	0.007	0.006	0.006
	Ethylene Oxide (tpy)	0.023	0.030	0.026	0.026

**BD Medical**  
**Columbus, Nebraska**  
**Ethylene Oxide Sterilization Chamber**  
**Catalytic Oxidizer**  
7/31/2015

**EPA Method 18: Determination of Gaseous Organic Compounds using Gas Chromatography**

Sample Analysis (Inlet)													
Run 1													
Cpd	Inj. 1	Sig.20128	Inj. 2	Sig.20129	Inj. 3	Sig.20130	Inj. 4	Sig.20131	Inj. 5	Sig.20132	Average		
ID	RT	AC	ppm										
Ethylene Oxide	2.043	34394	2.038	51246.6	2.032	43506.6	2.025	51600.3	2.011	35114.5	2.030	43172	2164.11
Run 2													
Cpd	Inj. 1	Sig.200133	Inj. 2	Sig.200135	Inj. 3	Sig.200136	Inj. 4	Sig.200137	Inj. 5	Sig.200138	Average		
ID	RT	AC	ppm										
Ethylene Oxide	1.992	46436.1	1.988	35743.2	1.985	39364.8	1.984	48275.5	1.981	45176.3	1.986	42999	2155.42
Run 3													
Cpd	Inj. 1	Sig.200139	Inj. 2	Sig.20140	Inj. 3	Sig.20141	Inj. 4	Sig.200142	Inj. 5	Sig.20143	Average		
ID	RT	AC	ppm										
Ethylene Oxide	1.963	44084.1	1.962	41323.4	1.962	37212.2	1.961	40429.5	1.961	38565.6	1.962	40323	2021.27

Sample Analysis (Outlet)													
Run 1													
Cpd	Inj. 1	Sig.10030	Inj. 2	Sig.10031	Inj. 3	Sig.10032	Inj. 4	Sig.10033	Inj. 5	Sig.10034	Average		
ID	RT	AC	ppm										
Ethylene Oxide	2.820	758.9	2.812	1296.8	2.802	1256.7	2.804	1215.0	2.802	1318	2.808	1169	0.16
Run 2													
Cpd	Inj. 1	Sig.10035	Inj. 2	Sig.10037	Inj. 3	Sig.10038	Inj. 4	Sig.10039	Inj. 5	Sig.10040	Average		
ID	RT	AC	ppm										
Ethylene Oxide	2.797	1267.6	2.799	2846.7	2.798	1634.9	2.803	1205.1	2.802	1190.1	2.800	1629	0.22
Run 3													
Cpd	Inj. 1	Sig.10041	Inj. 2	Sig.10042	Inj. 3	Sig.10043	Inj. 4	Sig.10044	Inj. 5	Sig.10045	Average		
ID	RT	AC	ppm										
Ethylene Oxide	2.799	1716.8	2.782	1278.9	2.790	1214.4	2.777	1313.4	2.782	1255.9	2.786	1356	0.18

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EPA Method 18: Determination of Gaseous Organic Compounds using Gas Chromatography

Inlet - Initial Three-Point Calibration									
High Level Calibration Standard									
Cpd ID	Conc. (ppm)	Inj. 1 RT	Sig. 20100 AC	Inj. 2 RT	Sig. 20101 AC	Inj. 3 RT	Sig. 20102 AC	RT	Average AC OK?
Ethylene Oxide	5210.00	2.174	99336.3	2.176	104394.0	2.177	103677.4	2.176	102469 Y

Mid-Level Calibration Standard									
Cpd ID	Conc. (ppm)	Inj. 1 RT	Sig. 20103 AC	Inj. 2 RT	Sig. 20104 AC	Inj. 3 RT	Sig. 20105 AC	RT	Average AC OK?
Ethylene Oxide	2605.00	2.180	56485.3	2.183	51946.8	2.181	54137.6	2.181	54190 Y

Low-Level Calibration Standard									
Cpd ID	Conc. (ppm)	Inj. 1 RT	Sig. 20106 AC	Inj. 2 RT	Sig. 20107 AC	Inj. 3 RT	Sig. 20108 AC	RT	Average AC OK?
Ethylene Oxide	1302.50	2.172	27370.7	2.168	28241.2	2.162	25647.4	2.167	27086 Y

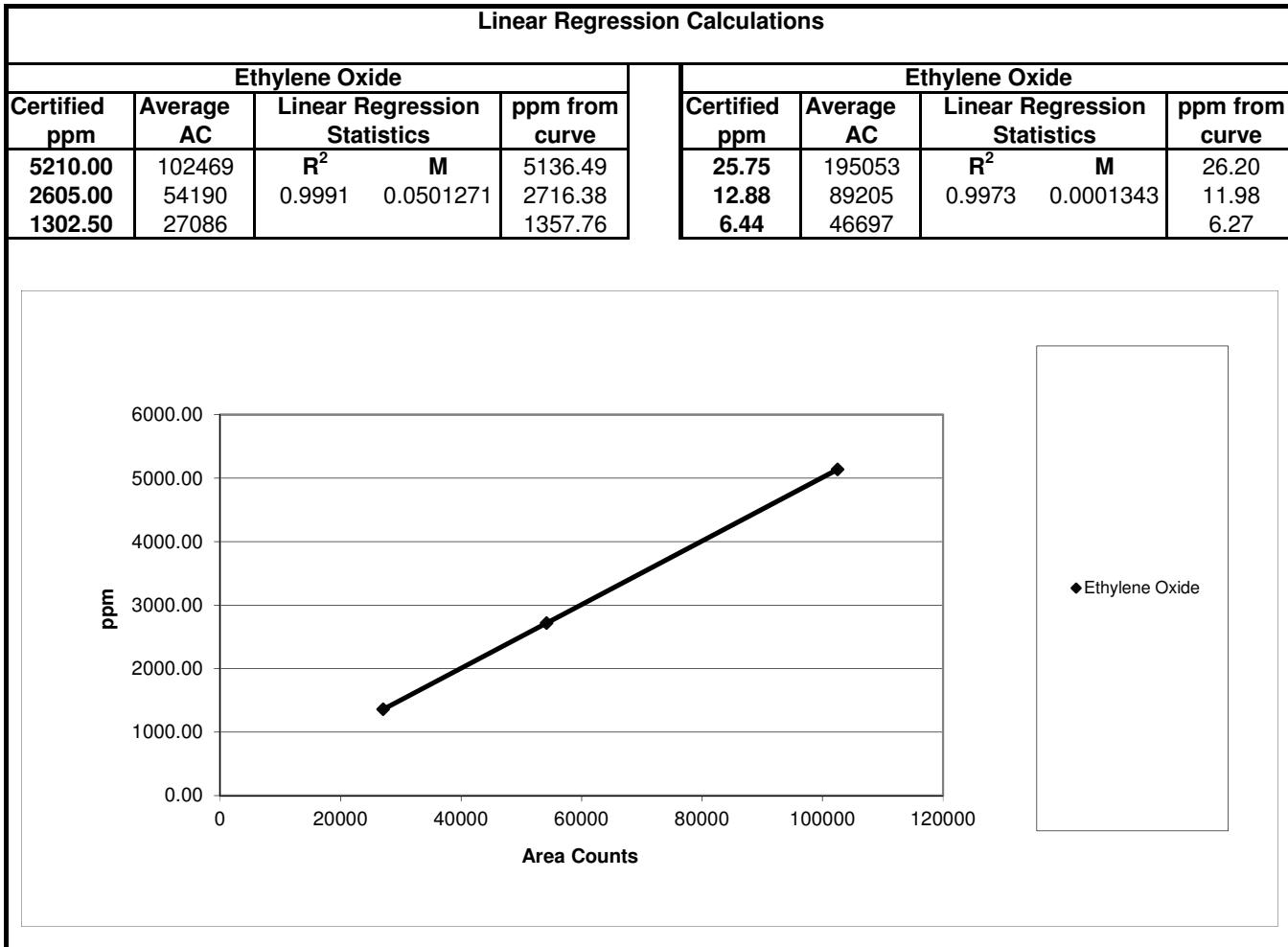
Outlet - Initial Three-Point Calibration									
High Level Calibration Standard									
Cpd ID	Conc. (ppm)	Inj. 1 RT	Sig. 10006 AC	Inj. 2 RT	Sig. 10007 AC	Inj. 3 RT	Sig. 10008 AC	RT	Average AC OK?
Ethylene Oxide	25.75	2.924	194887.1	2.924	203879.3	2.923	186393.6	2.924	195053 Y

Mid-Level Calibration Standard									
Cpd ID	Conc. (ppm)	Inj. 1 RT	Sig. 10013 AC	Inj. 2 RT	Sig. 10014 AC	Inj. 3 RT	Sig. 10015 AC	RT	Average AC OK?
Ethylene Oxide	12.88	2.916	89897.7	2.917	87386.6	2.915	90331.0	2.916	89205 Y

Low-Level Calibration Standard									
Cpd ID	Conc. (ppm)	Inj. 1 RT	Sig. 10010 AC	Inj. 2 RT	Sig. 10016 AC	Inj. 3 RT	Sig. 10017 AC	RT	Average AC OK?
Ethylene Oxide	6.44	2.919	46792.8	2.916	46823.5	2.909	46474.4	2.915	46697 Y

**BD Medical**  
**Columbus, Nebraska**  
**Ethylene Oxide Sterilization Chamber**  
**Catalytic Oxidizer**  
7/31/2015

**EPA Method 18: Determination of Gaseous Organic Compounds using Gas Chromatography**



**BD Medical**  
**Columbus, Nebraska**  
**Ethylene Oxide Sterilization Chamber**  
**Catalytic Oxidizer Inlet**  
 7/31/2015

**EPA Method 18: Determination of Gaseous Organic Compounds using Gas Chromatography**

Quality Assurance Inlet												
Inlet Line Loss Check (mid-level calibration gas to the sample probe)												
Cpd ID	Conc. (ppm)	Inj. 1 RT	Sig.20117 AC	Inj. 2 RT	Sig.20118 AC	Inj. 3 RT	Sig.20119 AC	Average RT	AC	ppm	TriPLICATE OK?	RECOVERY OK?
Ethylene Oxide	5210.00	2.088	110548.2	2.081	113753.5	2.076	113497.1	2.082	112600	5644.29	Y	Y
Inlet Post Test Calibration Check (mid-level calibration gas to the gas sampling valve)												
Cpd ID	Conc. (ppm)	Inj. 1 RT	Sig.20144 AC	Inj. 2 RT	Sig.20145 AC	Inj. 3 RT	Sig.20146 AC	Average RT	AC	ppm	TriPLICATE OK?	PRE/POST OK?
Ethylene Oxide	2605.00	1.973	50679.4	1.987	49996.5	1.996	49379.6	1.985	50019	2507.28	Y	Y

**BD Medical**  
**Columbus, Nebraska**  
**Ethylene Oxide Sterilization Chamber**  
**Catalytic Oxidizer Outlet**  
**7/31/2015**

**EPA Method 18: Determination of Gaseous Organic Compounds using Gas Chromatography**

Quality Assurance Outlet												
Outlet Line Loss Check (mid-level calibration gas to the sample probe)												
Cpd ID	Conc. (ppm)	Inj. 1 RT	Sig.10022 AC	Inj. 2 RT	Sig.10023 AC	Inj. 3 RT	Sig.10024 AC	Average RT	AC	ppm	Triplicate OK?	Recovery OK?
Ethylene Oxide	51.00	2.873	207635.6	2.871	209297.5	2.869	214212.4	2.871	210382	28.26	Y	Y
Outlet Post Test Calibration Check (mid-level calibration gas to the gas sampling valve)												
Cpd ID	Conc. (ppm)	Inj. 1 RT	Sig.10050 AC	Inj. 2 RT	Sig.10051 AC	Inj. 3 RT	Sig.10052 AC	Average RT	AC	ppm	Triplicate OK?	Pre/Post OK?
Ethylene Oxide	12.88	2.853	99456.4	2.86	99515.7	2.858	97543.9	2.857	98839	13.28	Y	Y

## **Sample Calculations**

**BD Medical**  
**Columbus, Nebraska**  
**Ethylene Oxide Sterilization Chamber**  
**Catalytic Oxidizer**  
7/31/2015

**EPA Methods 1-4: Determination of Stack Gas Velocity and Volumetric Flow Rate**

***Sample Calculations***

$$\text{sample volume (scf)} = \frac{17.64 * V_M * Y_D * \{P_B + \Delta H / 13.6\}}{T_M + 460}$$

$$= \frac{17.64 * 37.983 * 1.008 * \{ 28.35 + 1.0 / 13.6\}}{84 + 460}$$

$$= 35.273$$

$$\text{moisture volume (scf)} = 0.04715 * V_{LC}$$

$$= 0.04715 * 29.6$$

$$= 1.393$$

$$\text{moisture content (\% / 100)} = \frac{V_{W(STD)}}{(V_{M(STD)} + V_{W(STD)})}$$

$$= \frac{1.393}{(35.273 + 1.393)}$$

$$= 0.038$$

$$\text{molecular weight, dry (grams/mol)} = (0.440) * (\%CO_2) + (0.320) * (\%O_2) + (0.280) * (\%N_2 + \%CO)$$

$$= (0.440) * 0.0 + (0.320) * 20.9 + (0.280) * (79.1 + 0.0)$$

$$= 29.00$$

$$\text{molecular weight, actual (grams/mol)} = M_D * (1 - B_{WS}) + (18.0) * B_{WS}$$

$$= 29.00 * (1 - 0.038) + (18 * 0.038)$$

$$= 28.58$$

**BD Medical**  
**Columbus, Nebraska**  
**Ethylene Oxide Sterilization Chamber**  
**Catalytic Oxidizer**  
**7/31/2015**

**EPA Methods 1-4: Determination of Stack Gas Velocity and Volumetric Flow Rate**

**Sample Calculations (continued)**

$$\begin{aligned}
 \text{gas velocity (ft/sec)} &= 85.49 * C_P * \sqrt{\Delta P_{AVG} * \frac{T_S + 460}{[P_B + P_S / 13.6] * M_A}} \\
 &= (85.49) * 0.838 * 0.5436 * \sqrt{\left[ \frac{183 + 460}{28.35 + \frac{-0.20}{13.6}} \right] * 28.58} \\
 &= 34.7 \\
 \text{gas flow (acfpm)} &= 60 * \frac{\pi * (D_S / 12)^2}{4} * V_S \\
 &= 60 * \frac{\pi * (23.25 / 12)^2}{4} * 34.7 \\
 &= 6,139 \\
 \text{gas flow (dscfm)} &= 60 * V_S * (1 - B_{WS}) * \frac{\pi * (D_S / 12)^2}{4} * \frac{T_{STD} * [P_B + P_S / 13.6]}{(T_S + 460) * P_{STD}} \\
 &= 60 * 34.7 * (1 - 0.038) * \frac{\pi * (23.3 / 12)^2}{4} * \frac{528 * [28.35 + -0.20 / 13.6]}{(183 + 460) * 29.92} \\
 &= 4,592
 \end{aligned}$$

**BD Medical**  
**Columbus, Nebraska**  
**Ethylene Oxide Sterilization Chamber**  
**Catalytic Oxidizer**  
**7/31/2015**

**EPA Methods 1-4: Determination of Stack Gas Velocity and Volumetric Flow Rate**

**Variables and Abbreviations**

B<sub>WS</sub> - moisture content of the gas (wet volume percent/100)

%CO - carbon monoxide content of the gas (dry volume percent)

%CO<sub>2</sub> - carbon dioxide content of the gas (dry volume percent)

C<sub>P</sub> - pitot tube constant (unitless)

D<sub>S</sub> - diameter of the stack (inches)

ΔH - pressure differential at dry gas meter exit orifice (inches water)

M<sub>D</sub> - molecular weight of the dry gas (grams per mol)

M<sub>A</sub> - molecular weight of the wet gas (grams per mol)

%N<sub>2</sub> - nitrogen content of the gas (dry volume percent)

%O<sub>2</sub> - oxygen content of the gas (dry volume percent)

P<sub>Avg</sub> - average square root of the stack gas pitot differential pressure (inches water)

P<sub>B</sub> - barometric pressure (inches mercury)

P<sub>S</sub> - stack pressure relative to barometric pressure (inches water)

P<sub>STD</sub> - standard pressure (29.92 inches mercury)

T<sub>M</sub> - average dry gas meter temperature (°F)

T<sub>S</sub> - average stack temperature (°F)

T<sub>STD</sub> - standard temperature (528 °R)

V<sub>LC</sub> - volume of moisture collected as a liquid (milliliters)

V<sub>M</sub> - volume indicated on dry gas meter (uncorrected actual cubic feet)

V<sub>MSTD</sub> - volume of gas through dry gas meter (corrected dry standard cubic feet)

V<sub>S</sub> - stack gas velocity (feet per second)

V<sub>WSTD</sub> - volume of moisture collected as a gas at standard conditions (standard cubic feet)

Y<sub>D</sub> - dry gas meter calibration factor (unitless)

**BD Medical**  
**Columbus, Nebraska**  
**Ethylene Oxide Sterilization Chamber**  
**Catalytic Oxidizer**  
7/31/2015

### Determination Percent Destruction Removal Efficiency

#### *Sample Calculations*

$$\begin{aligned}\% \text{ DRE THC (lb/hr)} &= 100 * \left| 1 - \frac{\text{EO Out (lb/hr)}}{\text{EO In (lb/hr)}} \right| \\ &= 100 * \left| 1 - \frac{0.005}{66.18} \right| \\ &= 99.99\end{aligned}$$

#### Variables and Abbreviations

% DRE - percent destruction removal efficiency

EO - Ethylene oxide

lb/hr - pounds per hour



## Appendix Two: Field Data

## **Outlet Data**

Air Pollution Testing Inc.: EPA Method 2 - Pitot Traverse Datasheet											
Job #:	3B DM 5121 BPM East			Operator :	Logan	Code :		Stack Diameter (inches) :	23.25"		
Facility :	Site : Columbus, NE			Upstream Disturbance (inches) :	$\sim 20$			Downstream Disturbance (inches) :	$\sim 27$ "		
Date :	Points : 1 4.9 5 19.7 9			Schematic of Sampling Location:	1 6.4 6 22.7 10				Port = 4"		
Probe ID :	P-867			3 8.5 7 24.9 11	4 11.5 8 26.5 12						
Pitot Constant :	.938										
Pitot Tube Visual Check:	✓										
Run # : 1 out	O2% : CO2% : CDAS	CO2% : CDAS	O2% : CDAS	CO2% : CDAS	CDAS	CO2% : CDAS	O2% : CDAS	CO2% : CDAS	CDAS	CO2% : CDAS	CDAS
O2% :	CDAS	CO2% : measured / estimate	H2O% :	CDAS	measured / estimate	H2O% :	CDAS	CO2% : measured / estimate	CDAS	CO2% : measured / estimate	CDAS
H2O% :	CDAS	Ps ("H2O) : 22.0 - 20b (mbar) : 960	Ps ("H2O) : 22.0 - 20b (mbar) : 960	Ps ("H2O) : 22.0 - 20b (mbar) : 960	Ps ("H2O) : 22.0 - 20b (mbar) : 960	Ps ("H2O) : 22.0 - 20b (mbar) : 960	Ps ("H2O) : 22.0 - 20b (mbar) : 960	Ps ("H2O) : 22.0 - 20b (mbar) : 960	Ps ("H2O) : 22.0 - 20b (mbar) : 960	Ps ("H2O) : 22.0 - 20b (mbar) : 960	Ps ("H2O) : 22.0 - 20b (mbar) : 960
Ps ("H2O) :	22.0 - 20b (mbar) : 960	Start Time : 9:45	Stop Time : 9:51	Start Time : 10:55	Stop Time : 11:03	Start Time : 10:55	Stop Time : 11:03	Start Time : 10:55	Stop Time : 11:03	Start Time : 10:55	Stop Time : 11:03
Start Time :	9:45										
Post Test Pitot Leak Check Good? : 0.025" H2O	Post Test Pitot Leak Check Good? : 0.025" H2O										
Point #	Delta P	Ts	Notes	Point #	Delta P	Ts	Notes	Point #	Delta P	Ts	Notes
1-1	.35	183		1-1	.26	189		1-1	.33	186	
1-2	.33	183		1-2	.27	189		1-2	.33	181	
1-3	.31	183		1-3	.26	188		1-3	.32	181	
1-4	.30	184		1-4	.26	189		1-4	.31	182	
1-5	.27	185		1-5	.26	189		1-5	.30	183	
1-6	.26	184		1-6	.26	189		1-6	.26	183	
1-7	.26	183		1-7	.27	190		1-7	.26	184	
1-8	.25	183		1-8	.28	190		1-8	.24	183	
2-1	.32	182		2-1	.29	191		2-1	.25	182	
2-2	.33	182		2-2	.28	190		2-2	.26	183	
2-3	.33	182		2-3	.28	190		2-3	.26	182	
2-4	.31	181		2-4	.27	189		2-4	.27	183	
2-5	.29	184		2-5	.27	189		2-5	.29	184	
2-6	.28	184		2-6	.27	190		2-6	.29	184	
2-7	.28	185		2-7	.28	190		2-7	.31	184	
2-8	.27	181	AC	2-8	.28	190		2-8	.33	183	
Averages :	1.5436	193.3		Averages :	1.5207	195.5		Averages :	1.5360	192.75	

Reviewers Signature:

Air Pollution Testing, Inc. : EPA Method 4 - Moisture Determination Datasheet

APT Job #: 50005121 Date: 2/31/15

Location: Oxidizer Operator: Logan Cook

Run # 1 Meter Box ID: 115-19

Meter Box Yd: 1.008 Meter ΔH@: 1.56

Pre-Test Pump Leak Check: 0.00 Post-Test Pump Leak Check: 0.00

2/15/15 Post-Lab Check: 0.00

T<sub>m</sub> 79 Condenser Temp. 52 Probe Temp. 247

ΔH 1.0 Inlet Temp. 79 53 247

Vacuum 3 Office Setting 79 53 247

Sampling Time (minutes) 3 Inlet Temp. 79 53 247

Condenser Temp. 52 Probe Temp. 247

Probe Temp. (°F) 247

Meter Volume (ft<sup>3</sup>) 500.533

Initial Volume: 503.70

Notes Part ≈ 4"

Sampling Time (minutes) 5 Inlet Temp. 80 53 247

Condenser Temp. 53 247

Probe Temp. 247

Meter Volume (ft<sup>3</sup>) 500.46

Initial Volume: 516.03

Notes Part ≈ 4"

Sampling Time (minutes) 7 Inlet Temp. 81 53 248

Condenser Temp. 52 248

Probe Temp. 248

Meter Volume (ft<sup>3</sup>) 516.24

Initial Volume: 518.52

Notes Part ≈ 4"

Sampling Time (minutes) 10 Inlet Temp. 82 53 249

Condenser Temp. 51 249

Probe Temp. 249

Meter Volume (ft<sup>3</sup>) 523.67

Initial Volume: 525.45

Notes Part ≈ 4"

Sampling Time (minutes) 15 Inlet Temp. 83 52 248

Condenser Temp. 50 248

Probe Temp. 248

Meter Volume (ft<sup>3</sup>) 532.18

Initial Volume: 533.36

Notes Part ≈ 4"

Sampling Time (minutes) 20 Inlet Temp. 84 51 249

Condenser Temp. 50 249

Probe Temp. 249

Meter Volume (ft<sup>3</sup>) 535.35

Initial Volume: 536.52

Notes Part ≈ 4"

Sampling Time (minutes) 25 Inlet Temp. 85 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 536.52

Initial Volume: 537.983

Notes Part ≈ 4"

Sampling Time (minutes) 30 Inlet Temp. 86 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 537.983

Initial Volume: 538.52

Notes Part ≈ 4"

Sampling Time (minutes) 35 Inlet Temp. 87 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 538.52

Initial Volume: 539.04

Notes Part ≈ 4"

Sampling Time (minutes) 40 Inlet Temp. 88 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 539.04

Initial Volume: 540.52

Notes Part ≈ 4"

Sampling Time (minutes) 45 Inlet Temp. 89 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 540.52

Initial Volume: 541.0

Notes Part ≈ 4"

Sampling Time (minutes) 50 Inlet Temp. 90 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 541.0

Initial Volume: 542.52

Notes Part ≈ 4"

Sampling Time (minutes) 55 Inlet Temp. 91 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 542.52

Initial Volume: 543.0

Notes Part ≈ 4"

Sampling Time (minutes) 60 Inlet Temp. 92 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 543.0

Initial Volume: 544.52

Notes Part ≈ 4"

Sampling Time (minutes) 65 Inlet Temp. 93 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 544.52

Initial Volume: 545.0

Notes Part ≈ 4"

Sampling Time (minutes) 70 Inlet Temp. 94 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 545.0

Initial Volume: 546.52

Notes Part ≈ 4"

Sampling Time (minutes) 75 Inlet Temp. 95 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 546.52

Initial Volume: 547.0

Notes Part ≈ 4"

Sampling Time (minutes) 80 Inlet Temp. 96 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 547.0

Initial Volume: 548.52

Notes Part ≈ 4"

Sampling Time (minutes) 85 Inlet Temp. 97 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 548.52

Initial Volume: 549.0

Notes Part ≈ 4"

Sampling Time (minutes) 90 Inlet Temp. 98 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 549.0

Initial Volume: 550.52

Notes Part ≈ 4"

Sampling Time (minutes) 95 Inlet Temp. 99 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 550.52

Initial Volume: 551.0

Notes Part ≈ 4"

Sampling Time (minutes) 100 Inlet Temp. 100 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 551.0

Initial Volume: 552.52

Notes Part ≈ 4"

Sampling Time (minutes) 105 Inlet Temp. 101 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 552.52

Initial Volume: 553.0

Notes Part ≈ 4"

Sampling Time (minutes) 110 Inlet Temp. 102 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 553.0

Initial Volume: 554.52

Notes Part ≈ 4"

Sampling Time (minutes) 115 Inlet Temp. 103 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 554.52

Initial Volume: 555.0

Notes Part ≈ 4"

Sampling Time (minutes) 120 Inlet Temp. 104 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 555.0

Initial Volume: 556.52

Notes Part ≈ 4"

Sampling Time (minutes) 125 Inlet Temp. 105 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 556.52

Initial Volume: 557.0

Notes Part ≈ 4"

Sampling Time (minutes) 130 Inlet Temp. 106 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 557.0

Initial Volume: 558.52

Notes Part ≈ 4"

Sampling Time (minutes) 135 Inlet Temp. 107 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 558.52

Initial Volume: 559.0

Notes Part ≈ 4"

Sampling Time (minutes) 140 Inlet Temp. 108 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 559.0

Initial Volume: 560.52

Notes Part ≈ 4"

Sampling Time (minutes) 145 Inlet Temp. 109 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 560.52

Initial Volume: 561.0

Notes Part ≈ 4"

Sampling Time (minutes) 150 Inlet Temp. 110 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 561.0

Initial Volume: 562.52

Notes Part ≈ 4"

Sampling Time (minutes) 155 Inlet Temp. 111 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 562.52

Initial Volume: 563.0

Notes Part ≈ 4"

Sampling Time (minutes) 160 Inlet Temp. 112 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 563.0

Initial Volume: 564.52

Notes Part ≈ 4"

Sampling Time (minutes) 165 Inlet Temp. 113 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 564.52

Initial Volume: 565.0

Notes Part ≈ 4"

Sampling Time (minutes) 170 Inlet Temp. 114 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 565.0

Initial Volume: 566.52

Notes Part ≈ 4"

Sampling Time (minutes) 175 Inlet Temp. 115 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 566.52

Initial Volume: 567.0

Notes Part ≈ 4"

Sampling Time (minutes) 180 Inlet Temp. 116 51 250

Condenser Temp. 50 250

Probe Temp. 250

Meter Volume (ft<sup>3</sup>) 567.0

Initial Volume: 568.52

Notes Part ≈ 4"

Sampling Time (minutes) 185 Inlet Temp. 117 51 250

Condenser Temp. 50 250

Probe Temp. 250

</div

Air Pollution Testing, Inc. : EPA Method 4 - Moisture Determination Datasheet

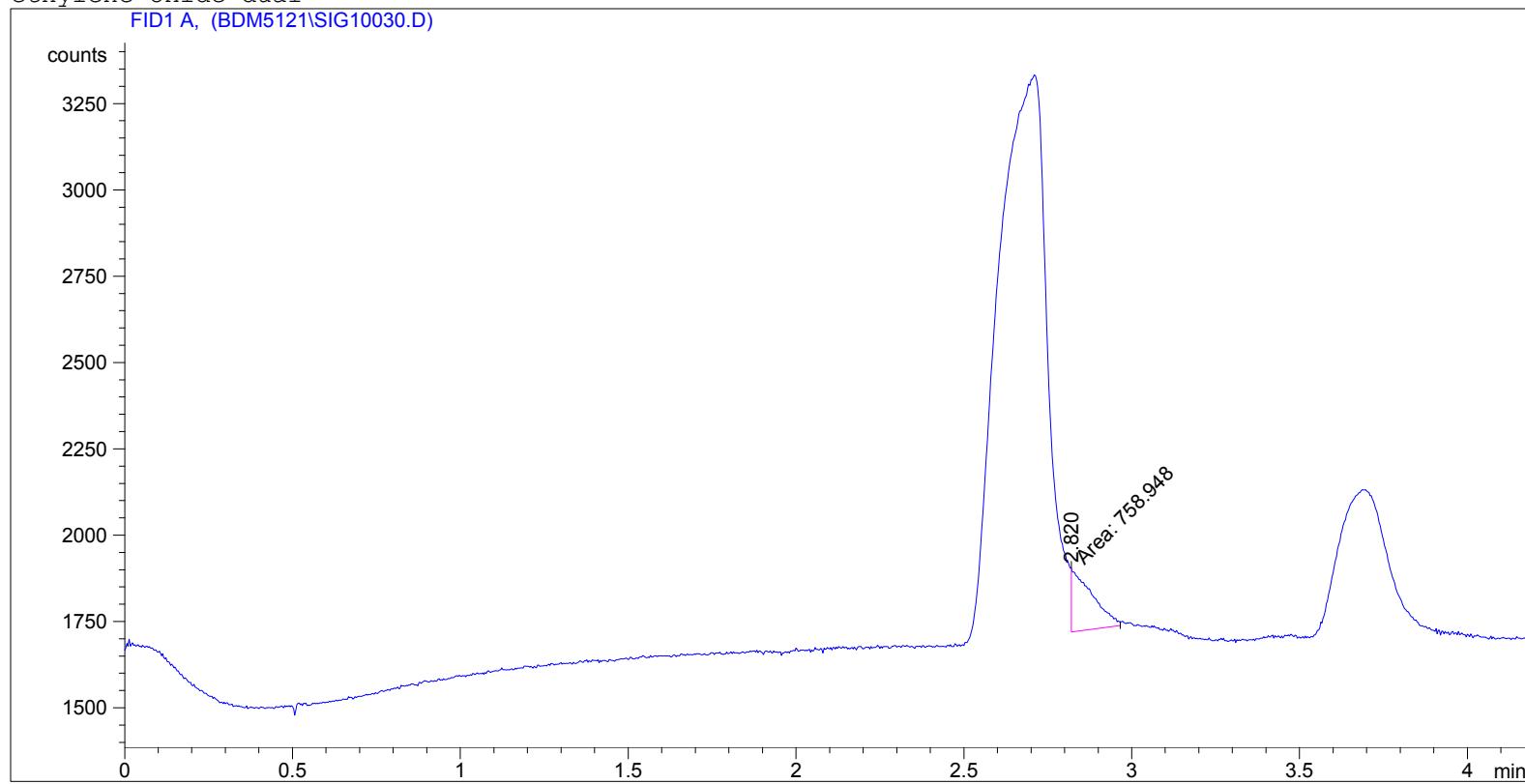
APT Job #: **BDM15121**  
 Location: **Columbus, NE Oxidizer** Operator: **Logan Cook**  
 Run #: **12** **dc** Meter Box ID: **M5-19**  
 Meter Box Y<sub>d</sub>: **1.008** Meter ΔH@: **1.56**  
 Pre-Test Pump Leak Check: **0.00015145** Post-Test Pump Leak Check: **0.0006160**

Sampling Time (minutes)	Vacuum (" Hg)	ΔH Orifice Setting (" H <sub>2</sub> O)	$T_m$		Condenser Temp. (°F)	Probe Temp. (°F)	Volume (ft <sup>3</sup> )	Notes	Schematic of Stack :	
			Inlet (°F)	Outlet (°F)					Initial Volume:	Final Volume:
5	3	1.0	92	89	62	247	541.03		538.588	
10	3	1.0	92	90	62	247	544.96	$\Delta P = 5207 \text{ (cut)}$		
15	3	1.0	93	90	61	247	549.02			$T_f = 82^\circ\text{C}$
20	3	1.0	94	90	60	249	551.20			
25	3	1.0	94	90	57	249	554.67			
30	3	1.0	96	91	54	249	558.01			
35	3	1.0	97	92	57	250	561.02			
40	3	1.0	97	93	57	249	563.83	$\Delta P = 4592 \text{ (JW)}$		
45	3	1.0	97	93	56	250	566.92			
50	3	1.0	98	93	57	251	570.14			
55	3	1.0	98	94	56	250	573.72			
60	3	1.0	99	94	57	251	576.452			
Stack ID (inches): <b>23.25 out 22.5 in</b>										
Upstream Disturbance (inches): <b>~2D</b>										
Downstream Disturbance (inches): <b>12.7"</b>										
200 gram Field Check of Scale (value):										
Moisture Determination										
Imp. #		Tare		Final		Gain				
1		424.3		430.5						
2		428.8		434.4						
3		299.5		304.5						
4		590.4		597.1						
Total		1743		1766.5		<b>23.5</b>				
Technician's Signature:		<i>J. C.K.</i>		Project Leader's Signature:						
maximum average difference										
total		<b>1.0</b>		<b>93.58</b>		<b>249</b>		<b>37.840</b>		



EO Outlet Run 1, Inj 1

```
=====
Injection Date : 7/31/2015 8:29:00 AM
Sample Name : Out Run 1, Inj 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.820	FM	0.0683	758.94824	185.24960	1.000e2

Totals : 758.94824 185.24960

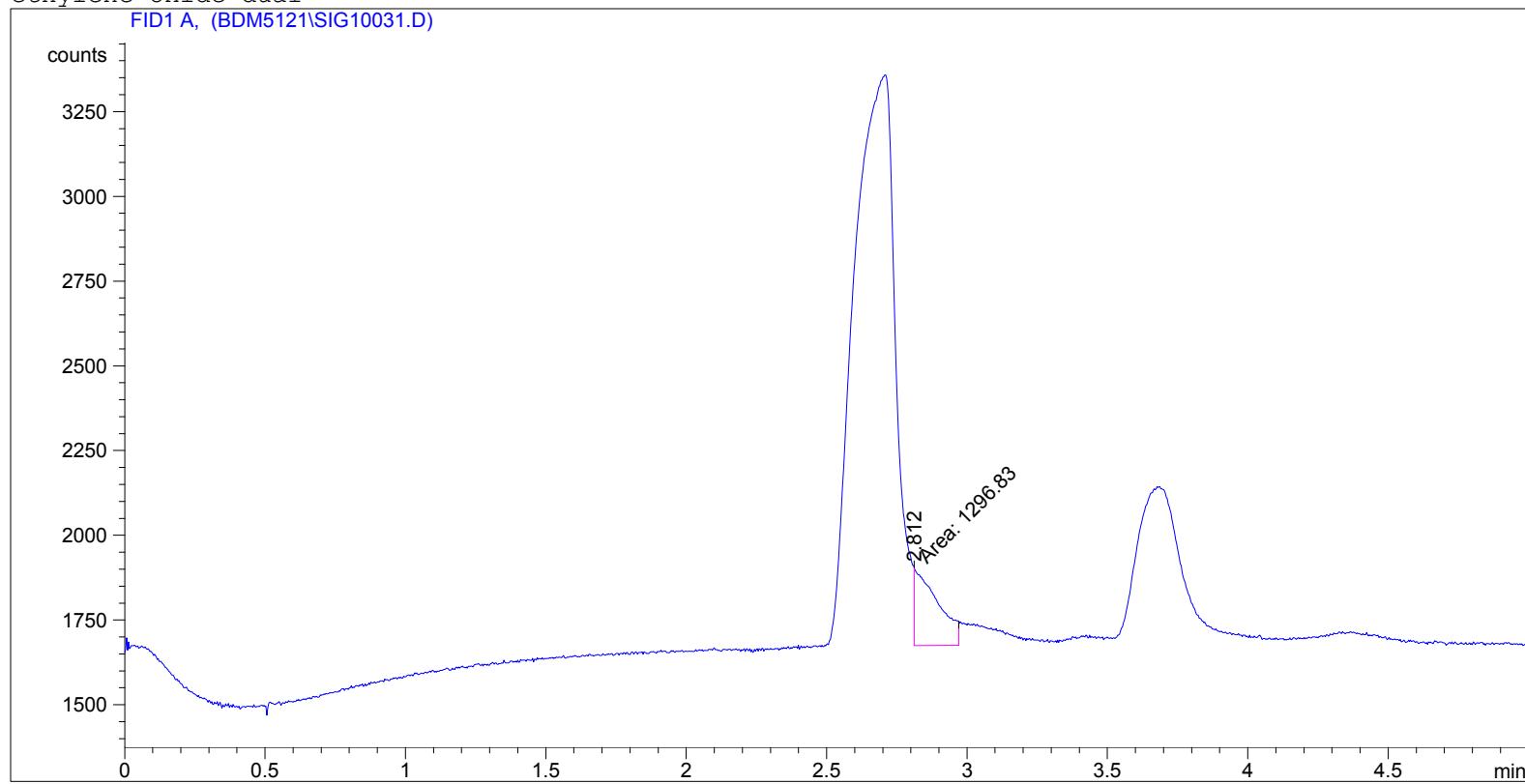
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Run 1, Inj 2

```
=====
Injection Date : 7/31/2015 8:38:12 AM
Sample Name : Out Run 1, Inj 2
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.812	MF	0.0937	1296.83386	230.58543	1.000e2

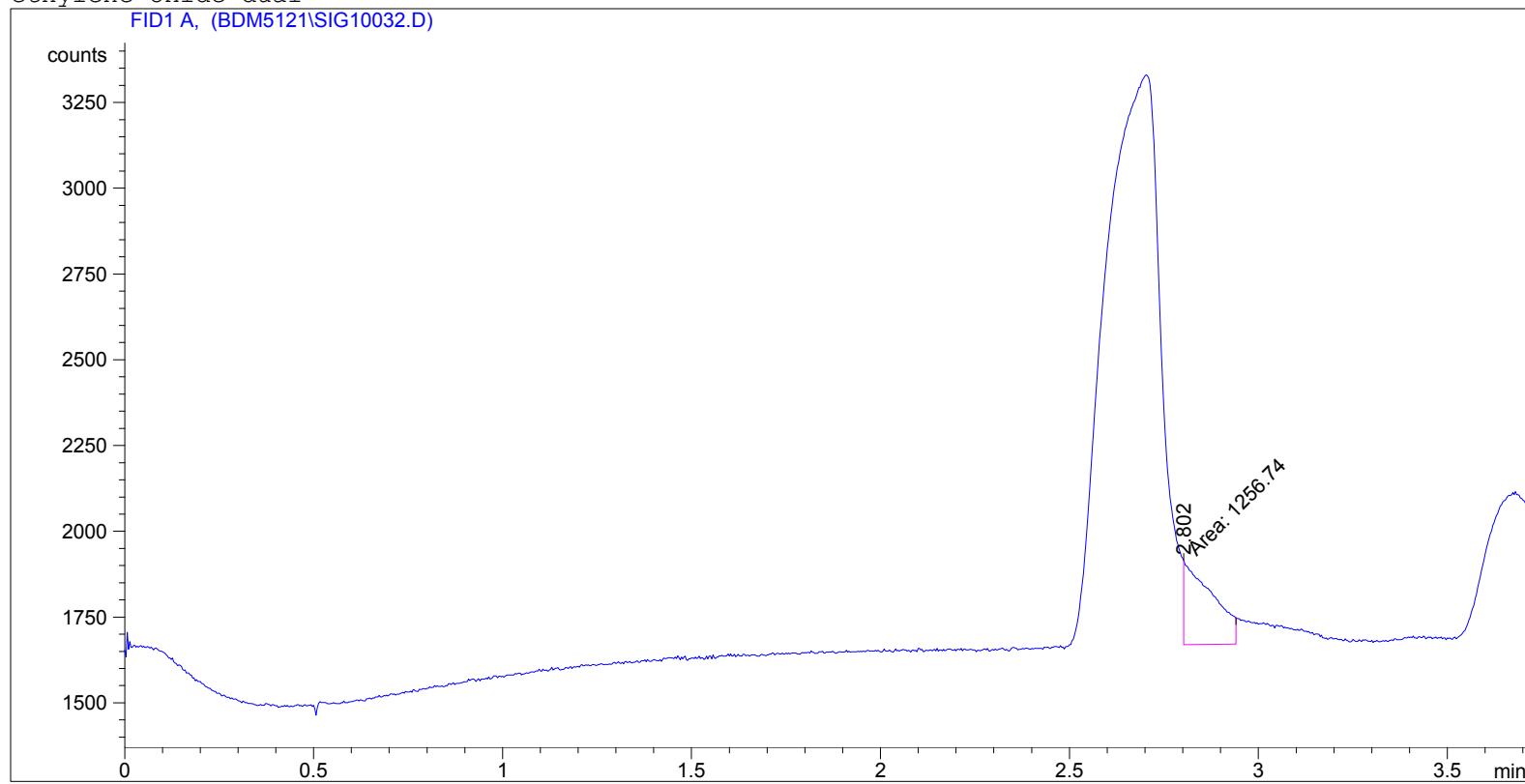
Totals : 1296.83386 230.58543

Results obtained with enhanced integrator!

=====  
\*\*\* End of Report \*\*\*

EO Outlet Run 1, Inj 3

```
=====
Injection Date : 7/31/2015 8:48:22 AM
Sample Name : Out Run 1, Inj 3
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.802	MF	0.0850	1256.74280	246.30307	1.000e2

Totals : 1256.74280 246.30307

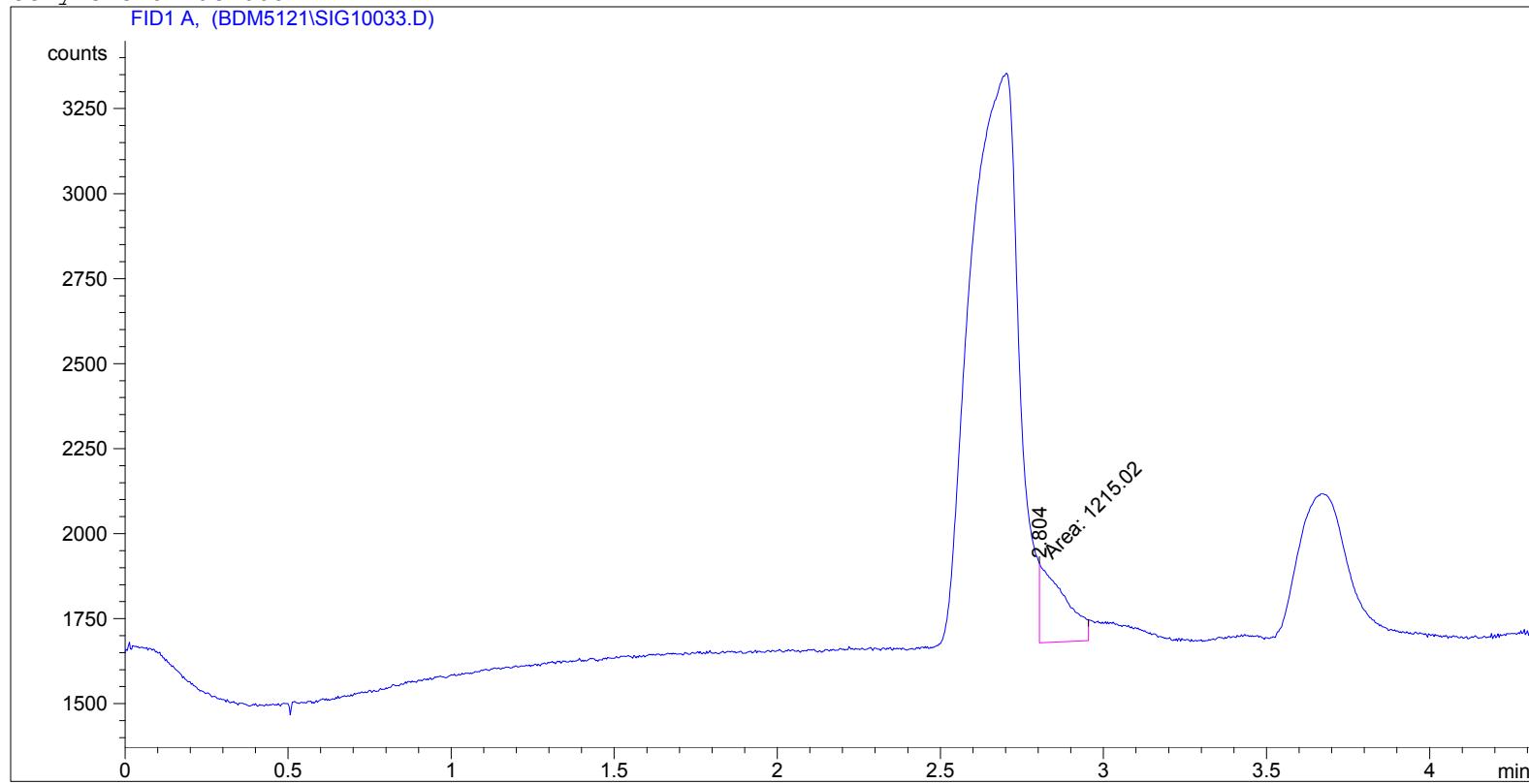
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Run 1, Inj 4

```
=====
Injection Date : 7/31/2015 8:58:29 AM
Sample Name : Out Run 1, Inj 4
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.804	MF	0.0634	1215.02429	233.61295	1.000e2

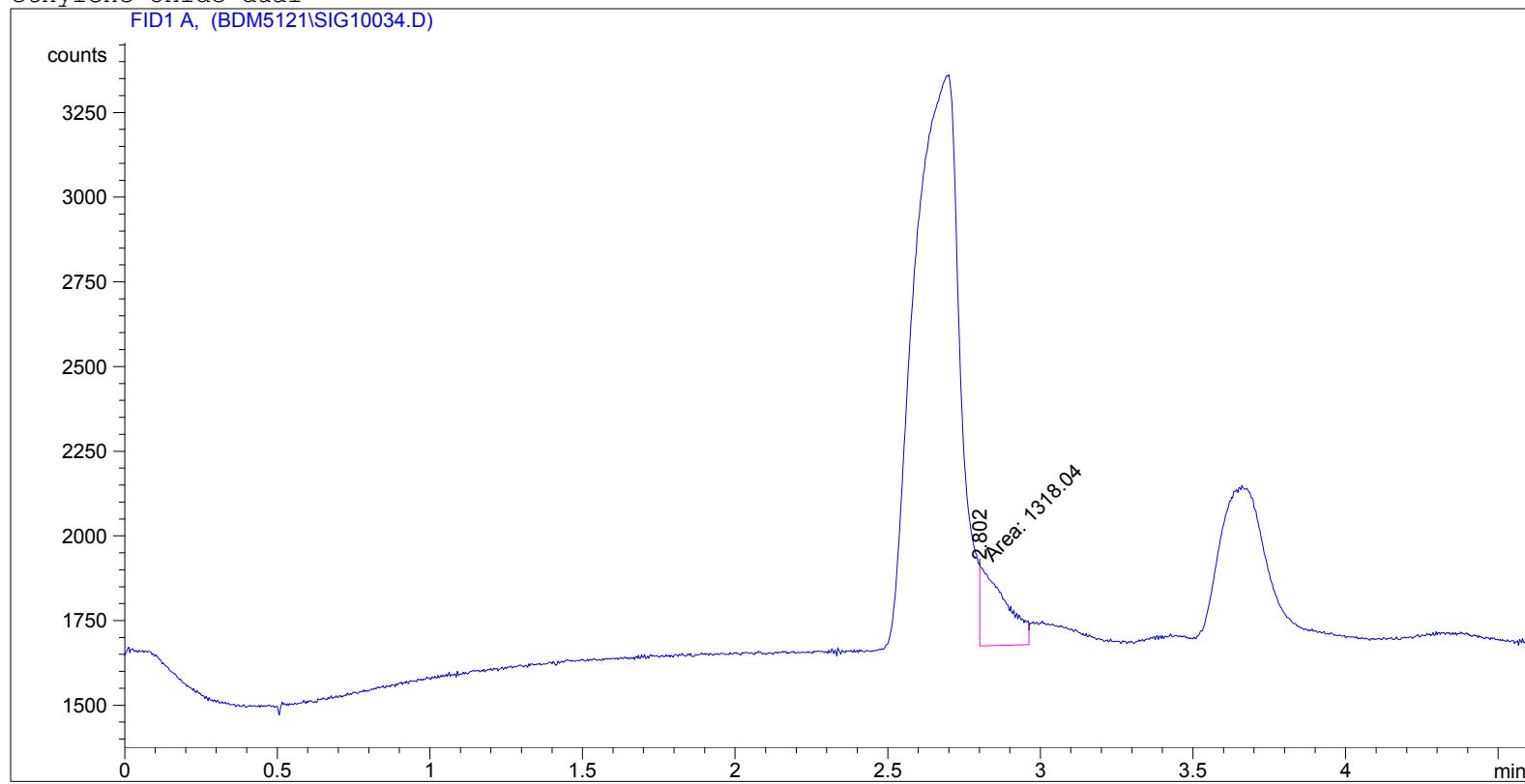
Totals : 1215.02429 233.61295

Results obtained with enhanced integrator!

===== \*\*\* End of Report \*\*\*

EO Outlet Run 1, Inj 5

```
=====
Injection Date : 7/31/2015 9:14:29 AM
Sample Name : Out Run 1, Inj 5
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.802	MF	0.0669	1318.03650	236.29396	1.000e2

Totals : 1318.03650 236.29396

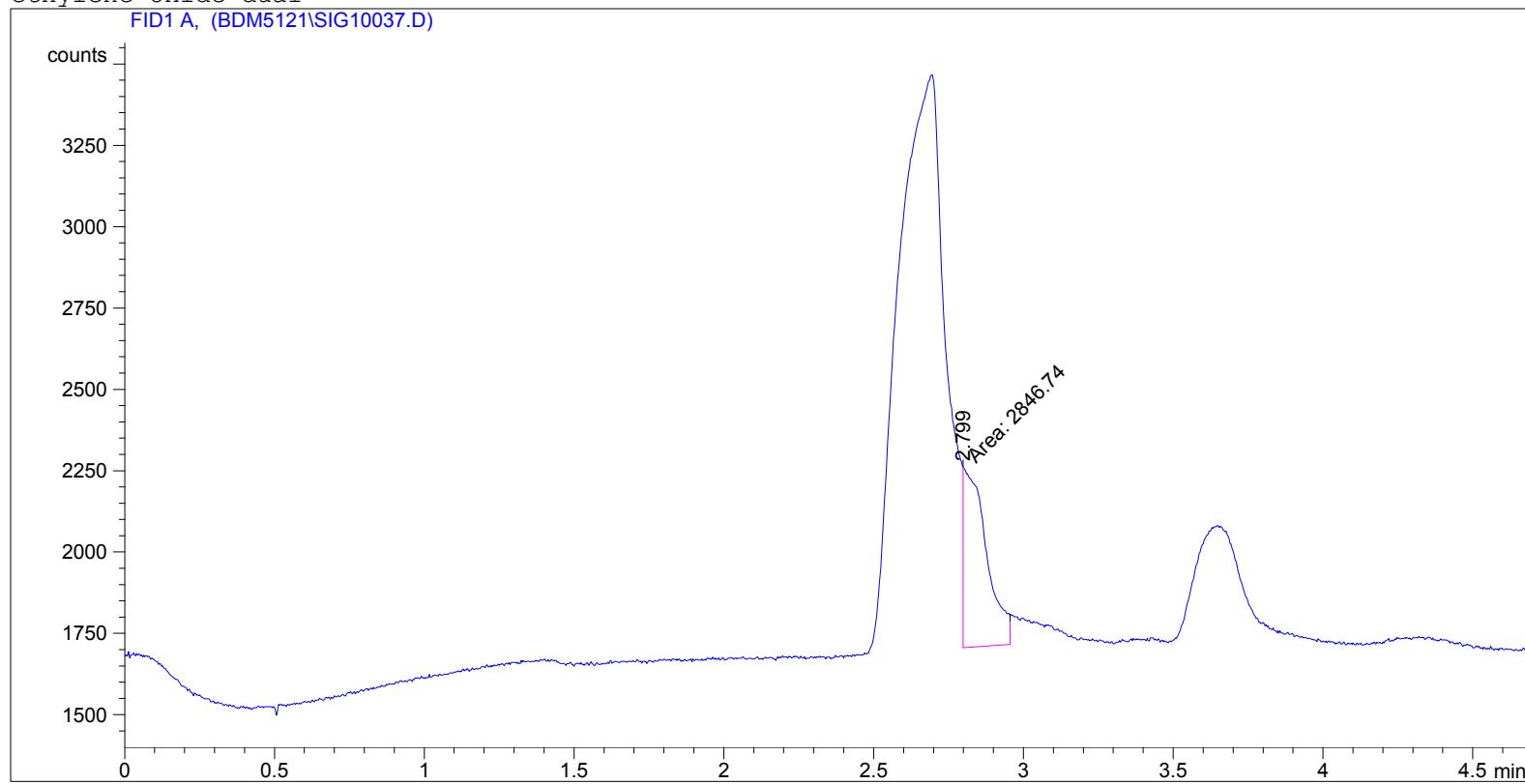
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Run 2, Inj 2

```
=====
Injection Date : 7/31/2015 10:01:28 AM
Sample Name : Out Run 2, Inj 2
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.799	MF	0.0607	2846.73779	556.68207	1.000e2

Totals : 2846.73779 556.68207

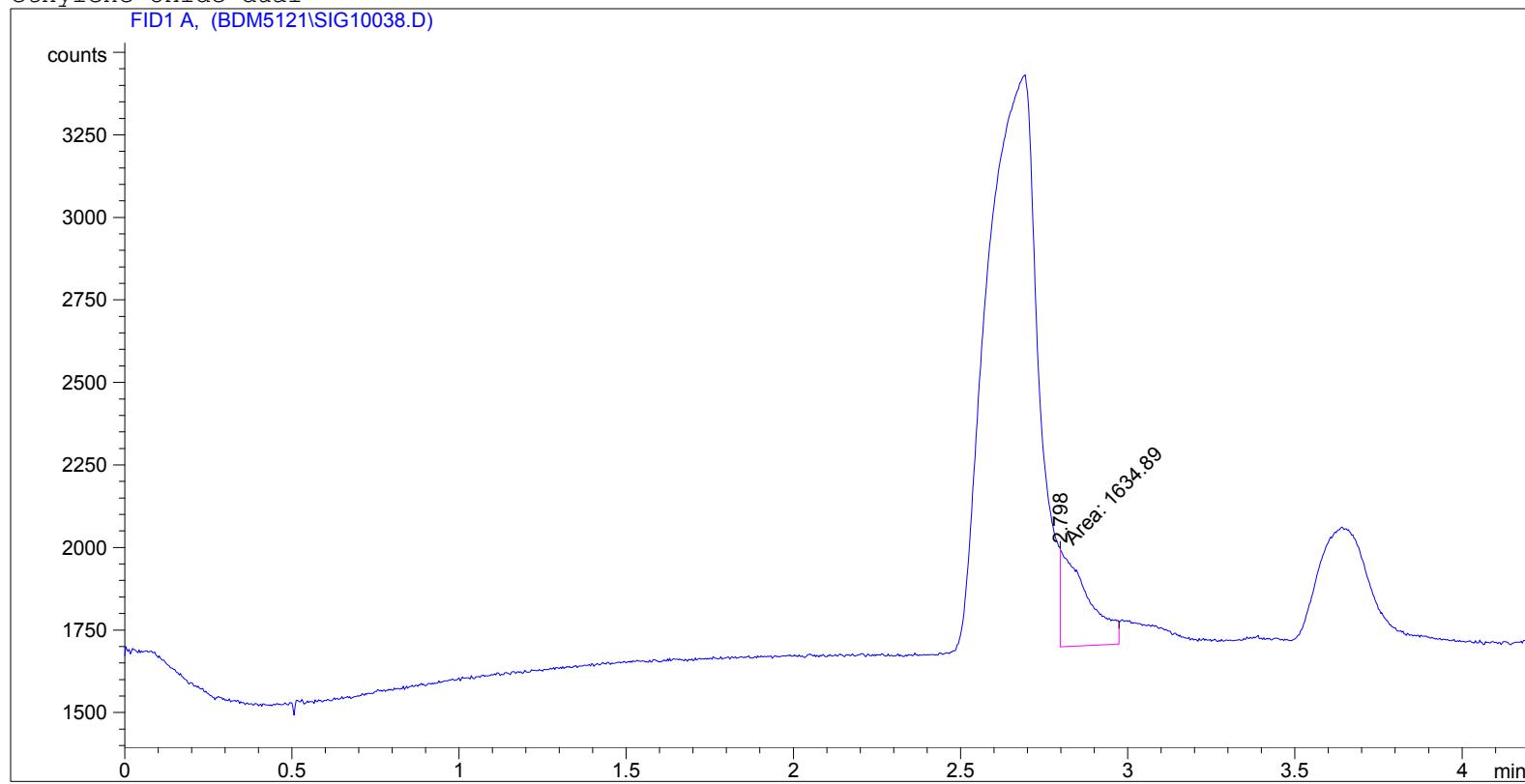
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Run 2, Inj 2

```
=====
Injection Date : 7/31/2015 10:10:39 AM
Sample Name : Out Run 2, Inj 2
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.798	FM	0.0921	1634.89050	296.01227	1.000e2

Totals : 1634.89050 296.01227

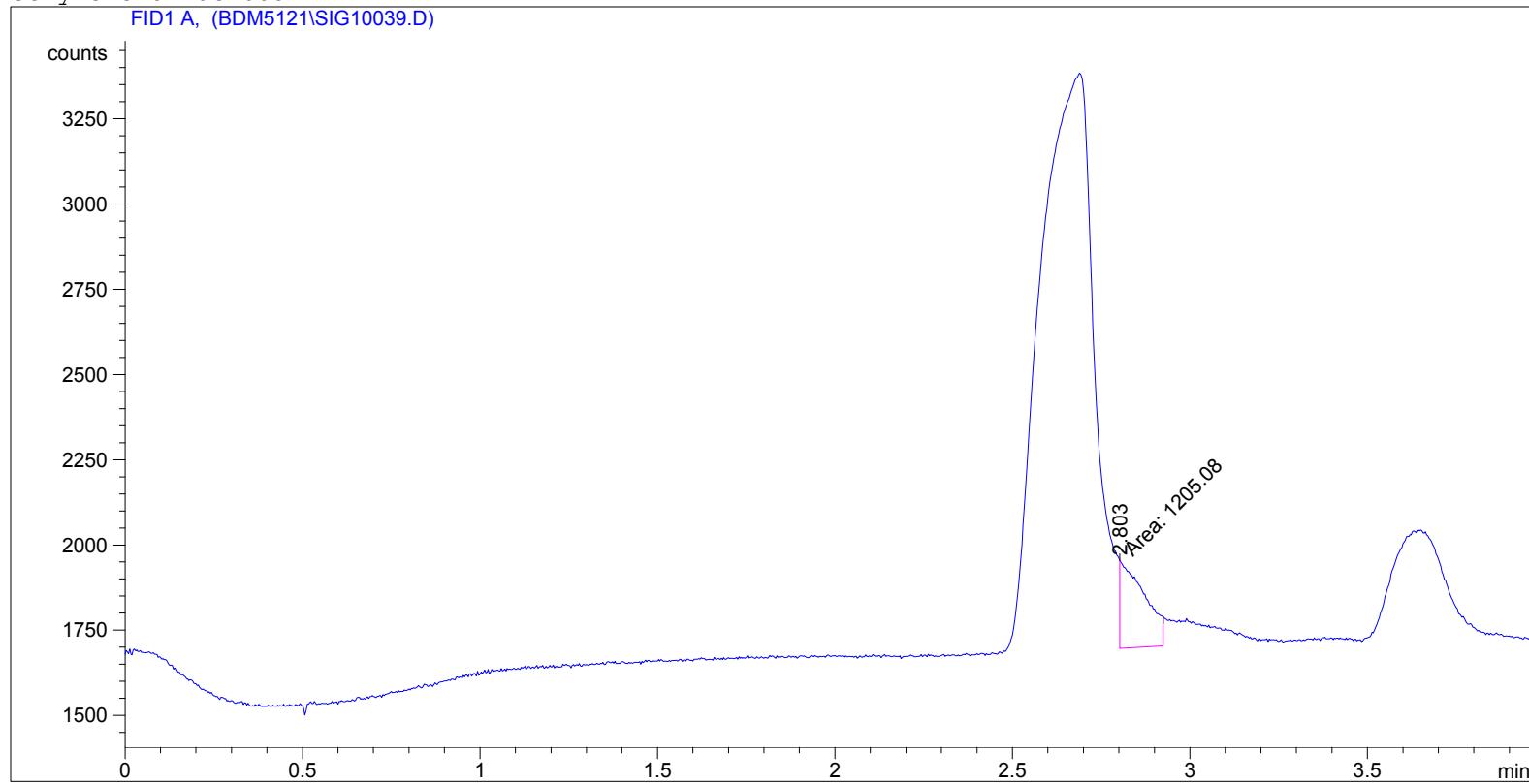
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Run 2, Inj 4

```
=====
Injection Date : 7/31/2015 10:18:15 AM
Sample Name : Out Run 2, Inj 4
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.803	MF	0.0782	1205.08264	256.99292	1.000e2

Totals : 1205.08264 256.99292

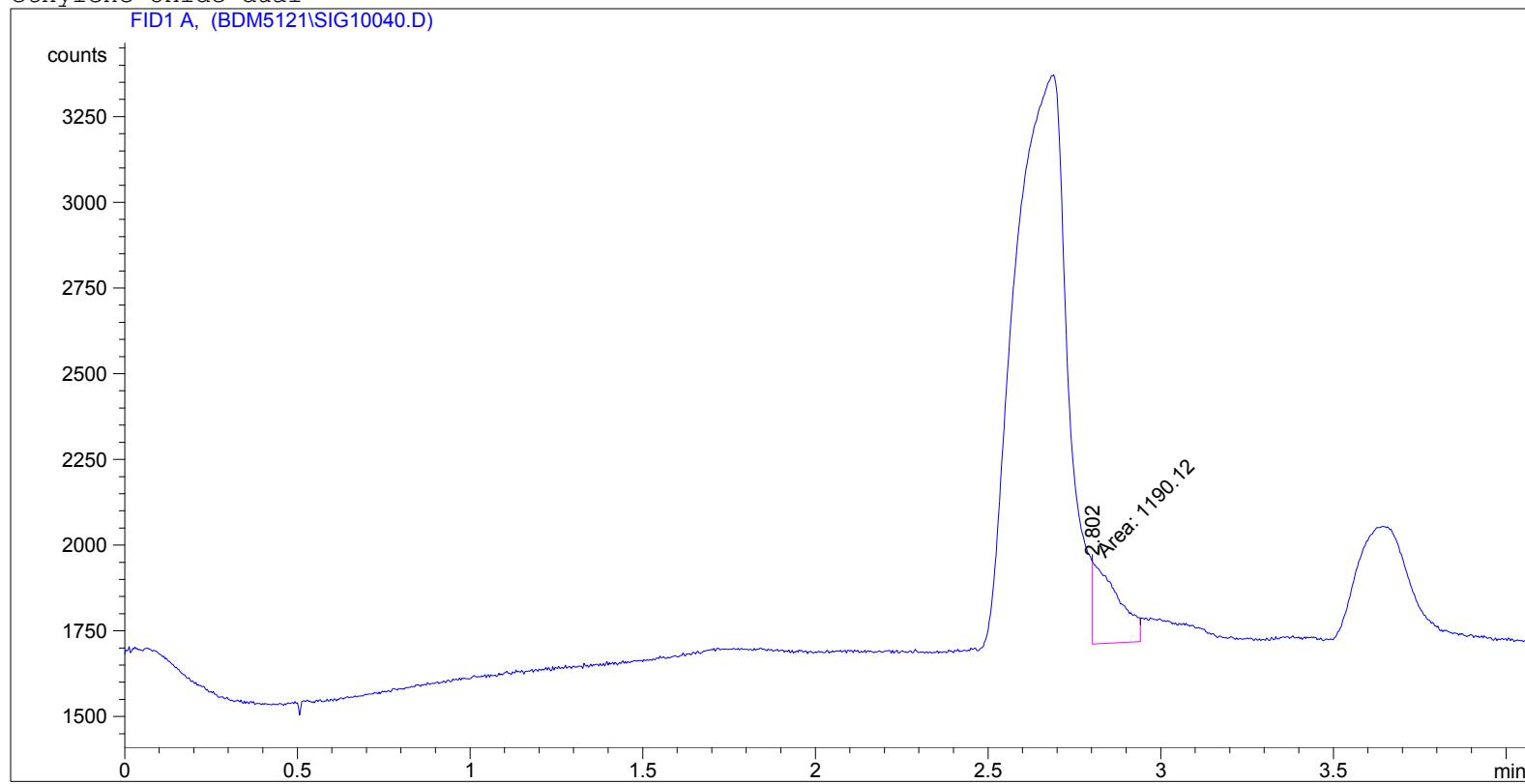
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Run 2, Inj 5

```
=====
Injection Date : 7/31/2015 10:25:14 AM
Sample Name : Out Run 2, Inj 5
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.802	MF	0.0594	1190.11633	241.00027	1.000e2

Totals : 1190.11633 241.00027

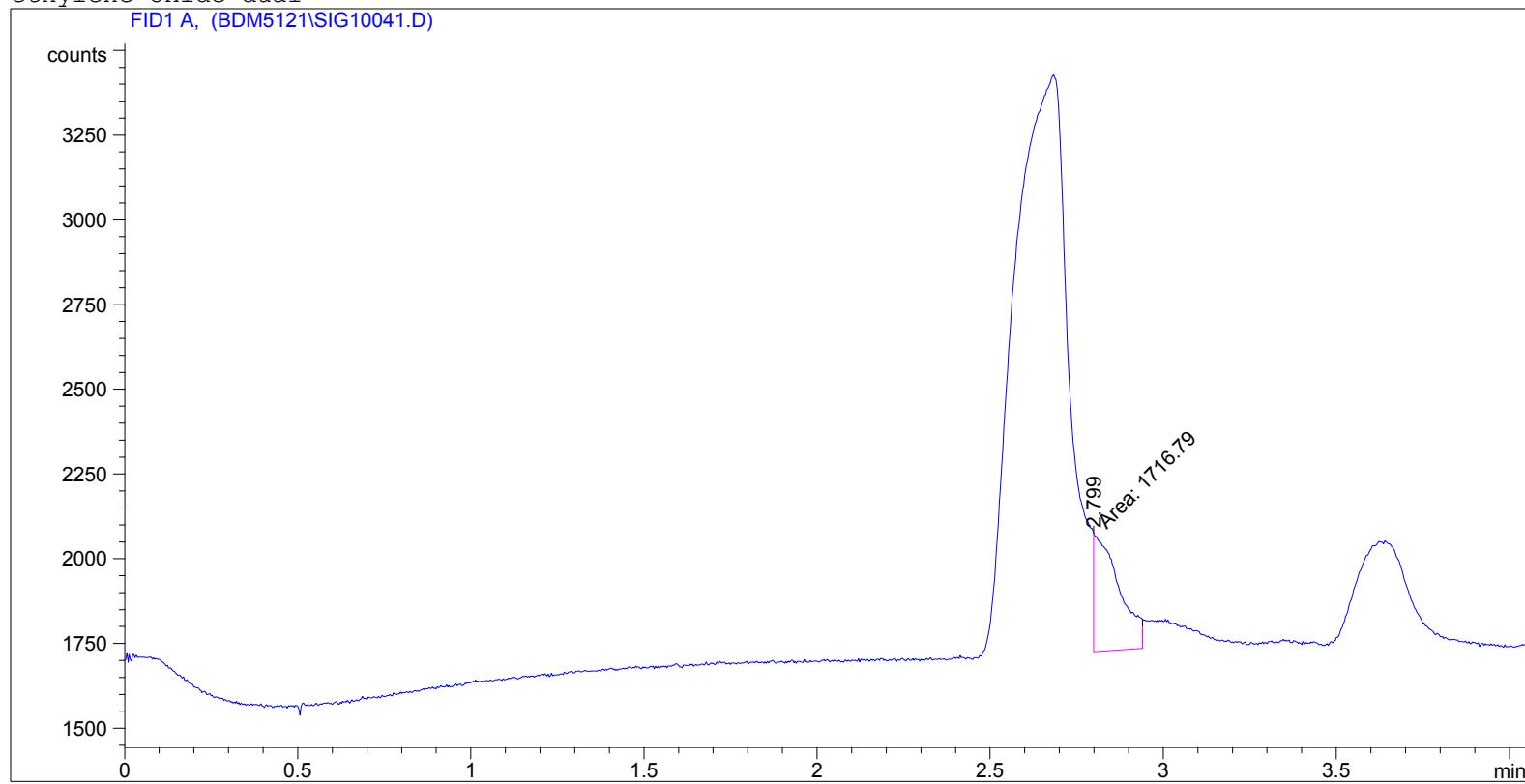
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Run 3, Inj 1

```
=====
Injection Date : 7/31/2015 11:26:37 AM
Sample Name : Out Run 3, Inj 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.799	FM	0.0815	1716.78711	351.17215	1.000e2

Totals : 1716.78711 351.17215

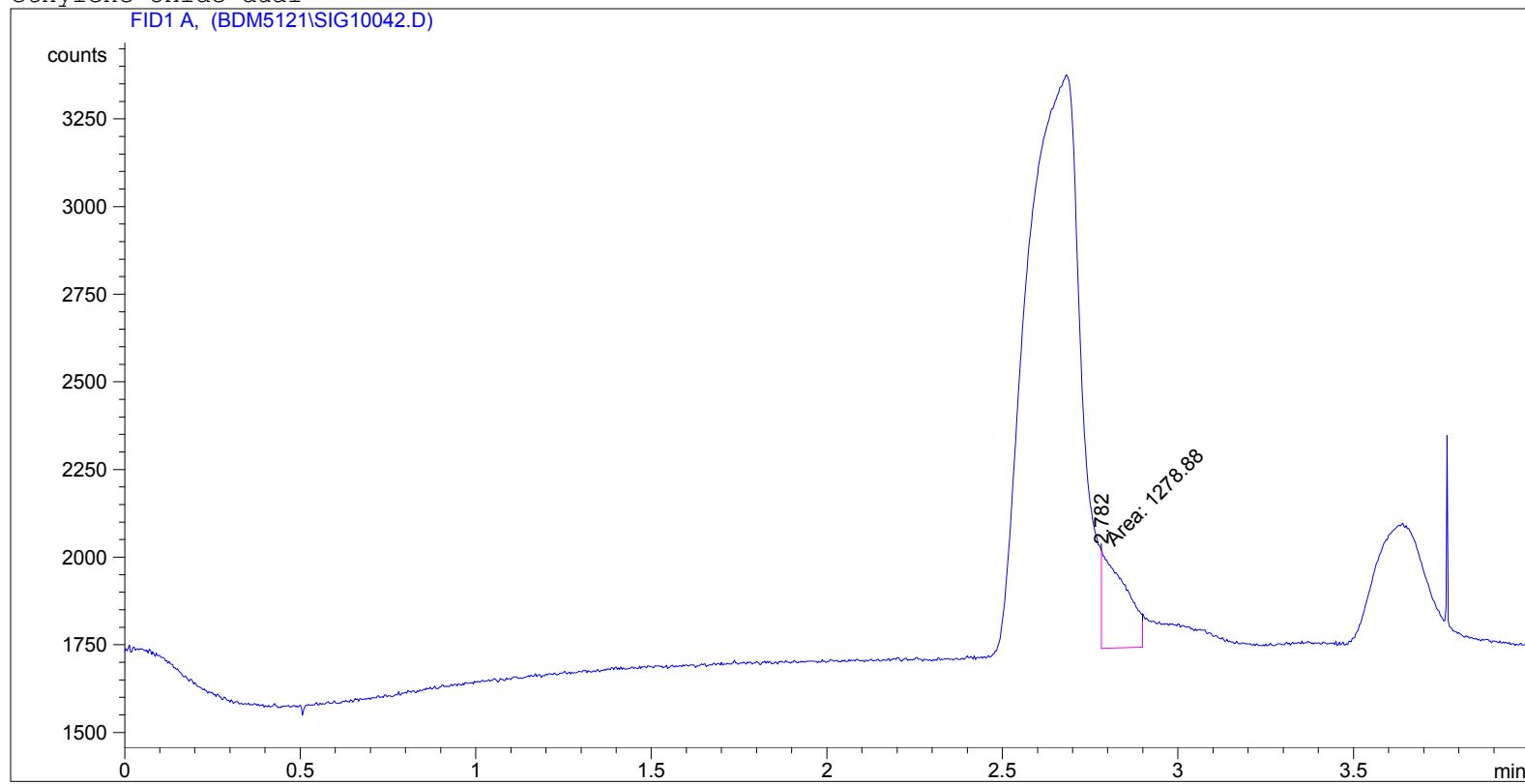
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Run 3, Inj 2

```
=====
Injection Date : 7/31/2015 11:35:12 AM
Sample Name : Out Run 3, Inj 2
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.782	MF	0.0544	1278.88049	279.82477	1.000e2

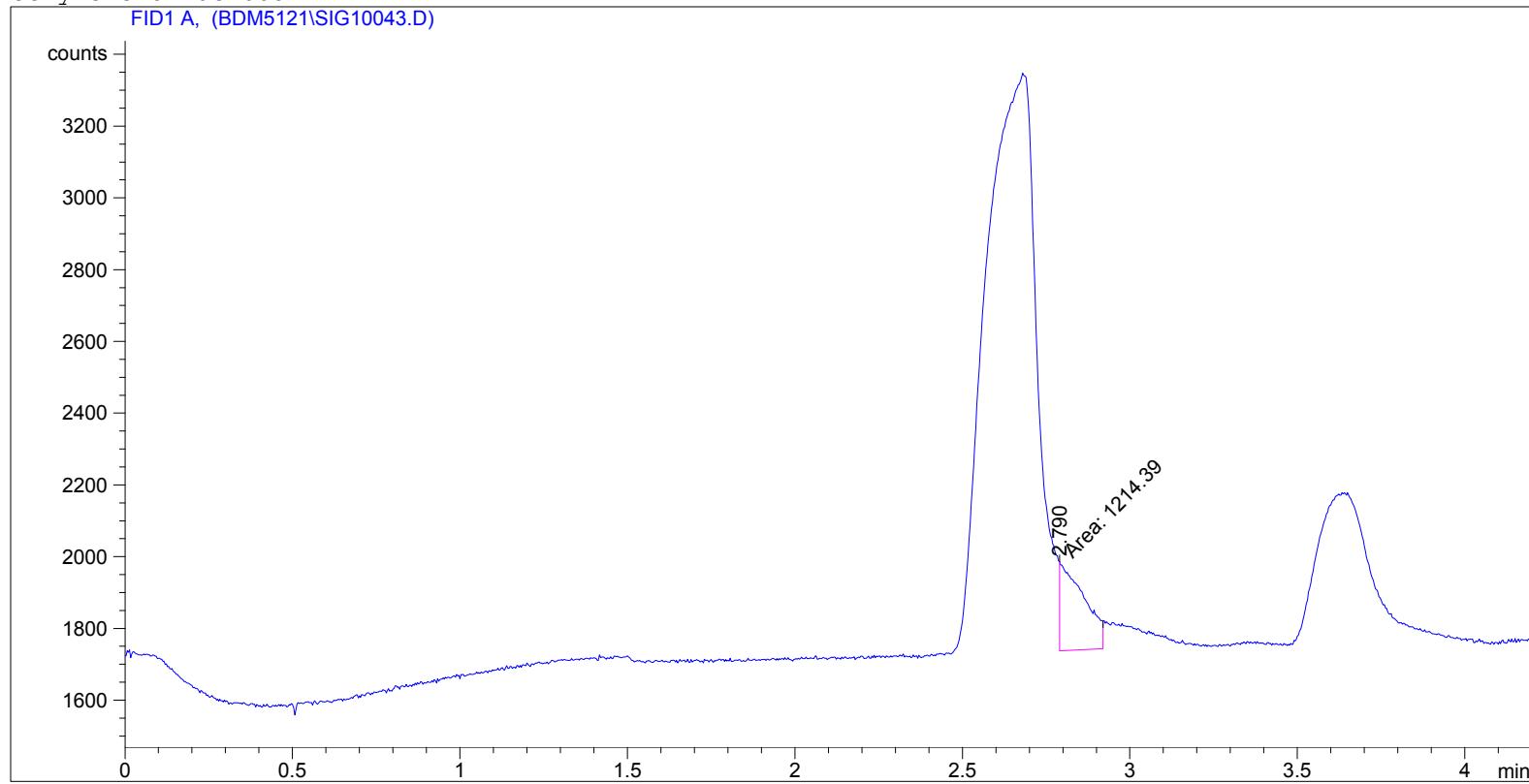
Totals : 1278.88049 279.82477

Results obtained with enhanced integrator!

=====  
\*\*\* End of Report \*\*\*

EO Outlet Run 3, Inj 3

```
=====
Injection Date : 7/31/2015 11:40:05 AM
Sample Name : Out Run 3, Inj 3
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.790	MF	0.0580	1214.38623	247.96021	1.000e2

Totals : 1214.38623 247.96021

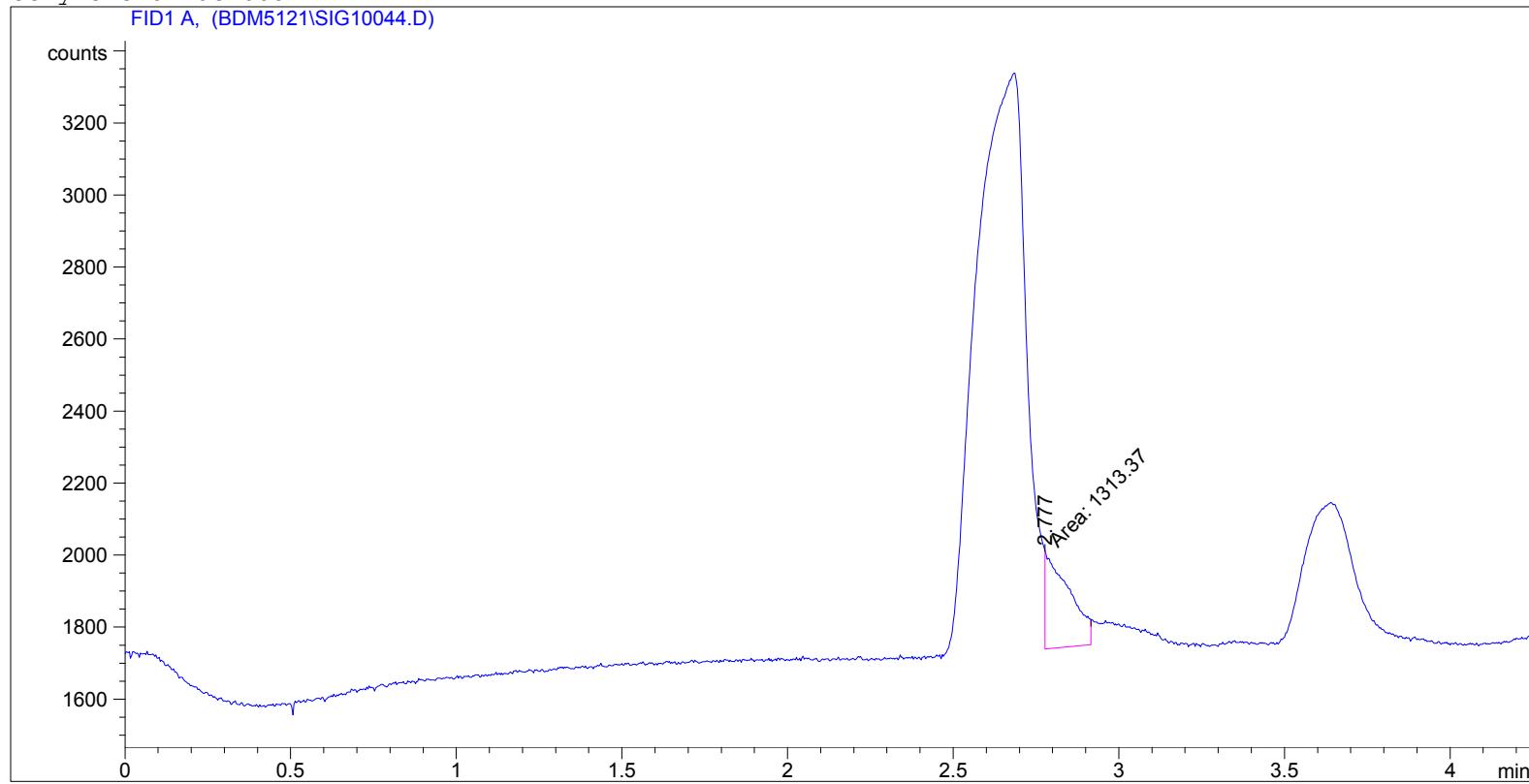
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Run 3, Inj 4

```
=====
Injection Date : 7/31/2015 11:47:57 AM
Sample Name : Out Run 3, Inj 4
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.777	MF	0.0571	1313.36633	270.67801	1.000e2

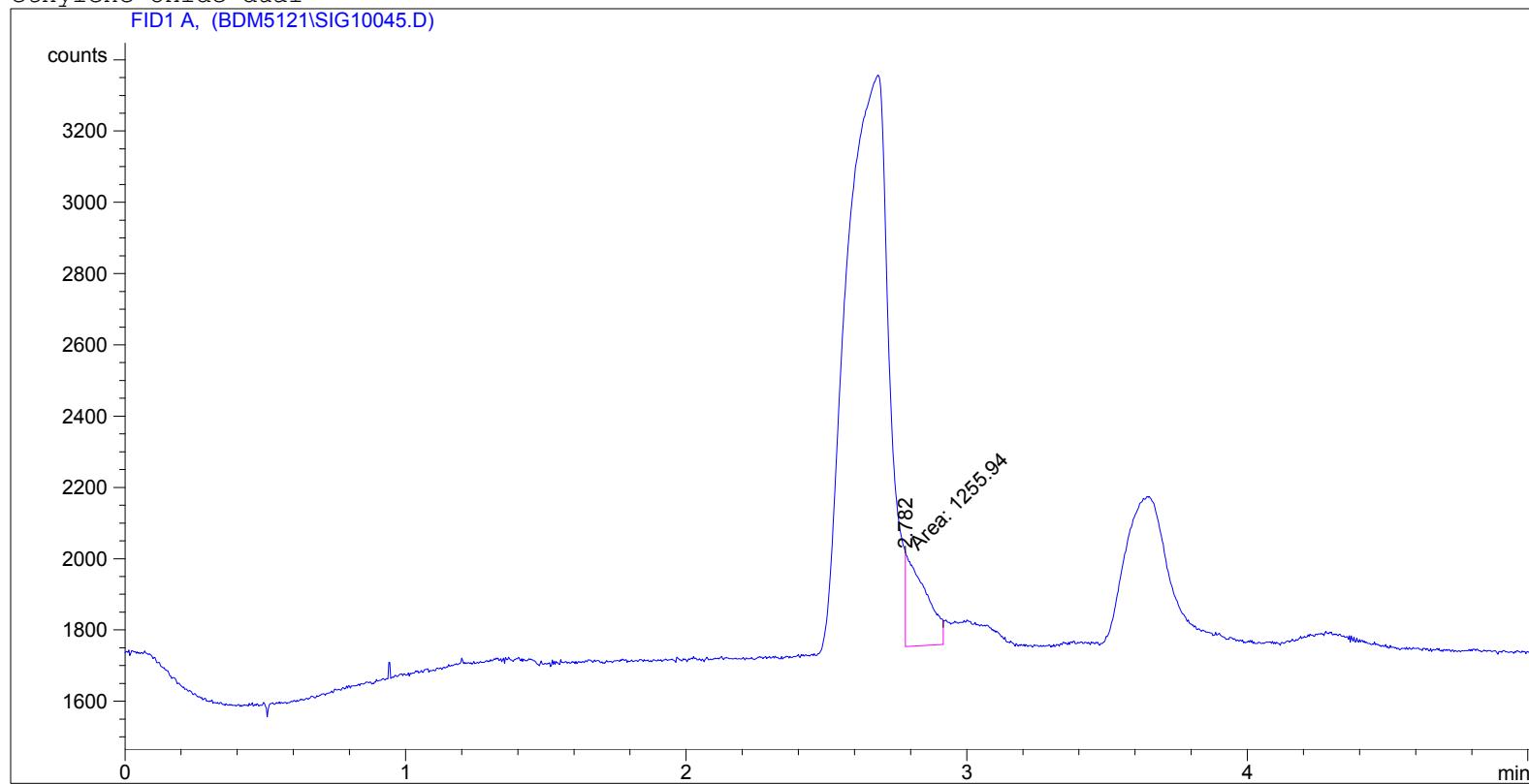
Totals : 1313.36633 270.67801

Results obtained with enhanced integrator!

=====  
\*\*\* End of Report \*\*\*

EO Outlet Run 3, Inj 5

```
=====
Injection Date : 7/31/2015 11:52:56 AM
Sample Name : Out Run 3, Inj 5
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.782	FM	0.0810	1255.93738	258.51480	1.000e2

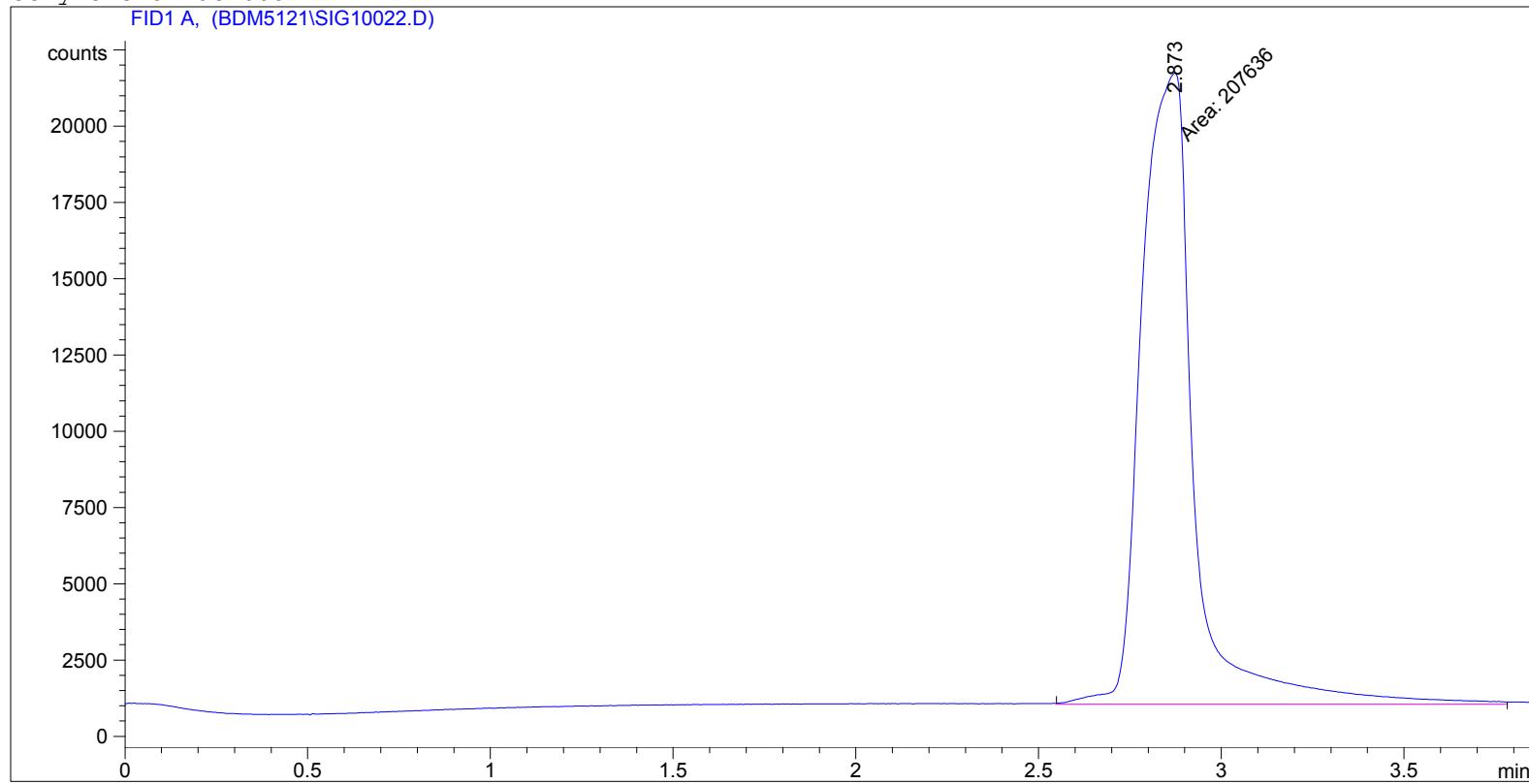
Totals : 1255.93738 258.51480

Results obtained with enhanced integrator!

===== \*\*\* End of Report \*\*\*

EO Outlet Line Loss 51ppm

```
=====
Injection Date : 7/30/2015 11:47:46 AM
Sample Name : Out Line Loss
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width MM	Area counts*s	Height [counts]	Area %
1	2.873	MM	0.1672	2.07636e5	2.06926e4	1.000e2

Totals : 2.07636e5 2.06926e4

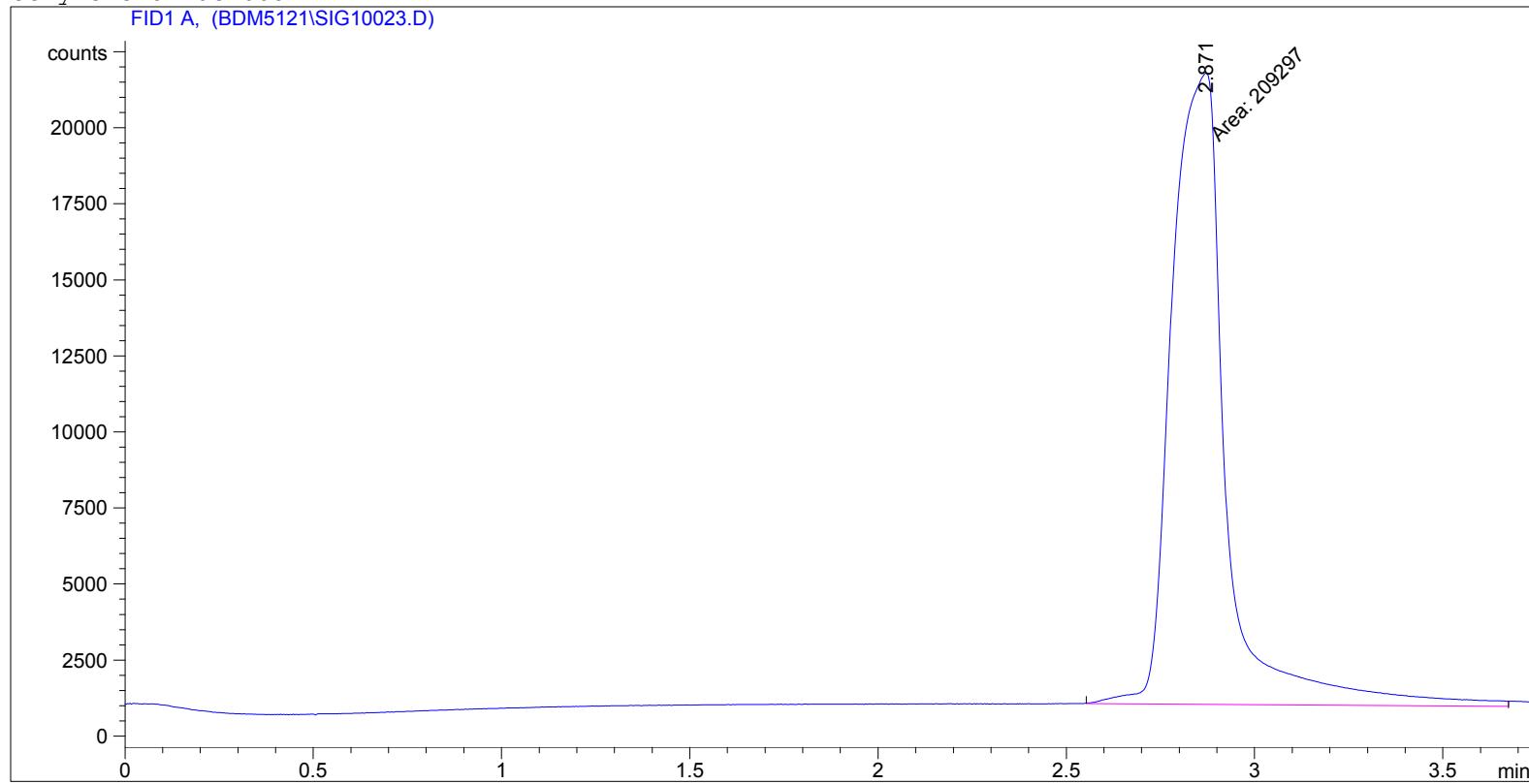
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Line Loss 51ppm

```
=====
Injection Date : 7/30/2015 11:53:29 AM
Sample Name : Out Line Loss
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width MM	Area counts*s	Height [counts]	Area %
1	2.871	MM	0.1681	2.09297e5	2.07558e4	1.000e2

Totals : 2.09297e5 2.07558e4

Results obtained with enhanced integrator!

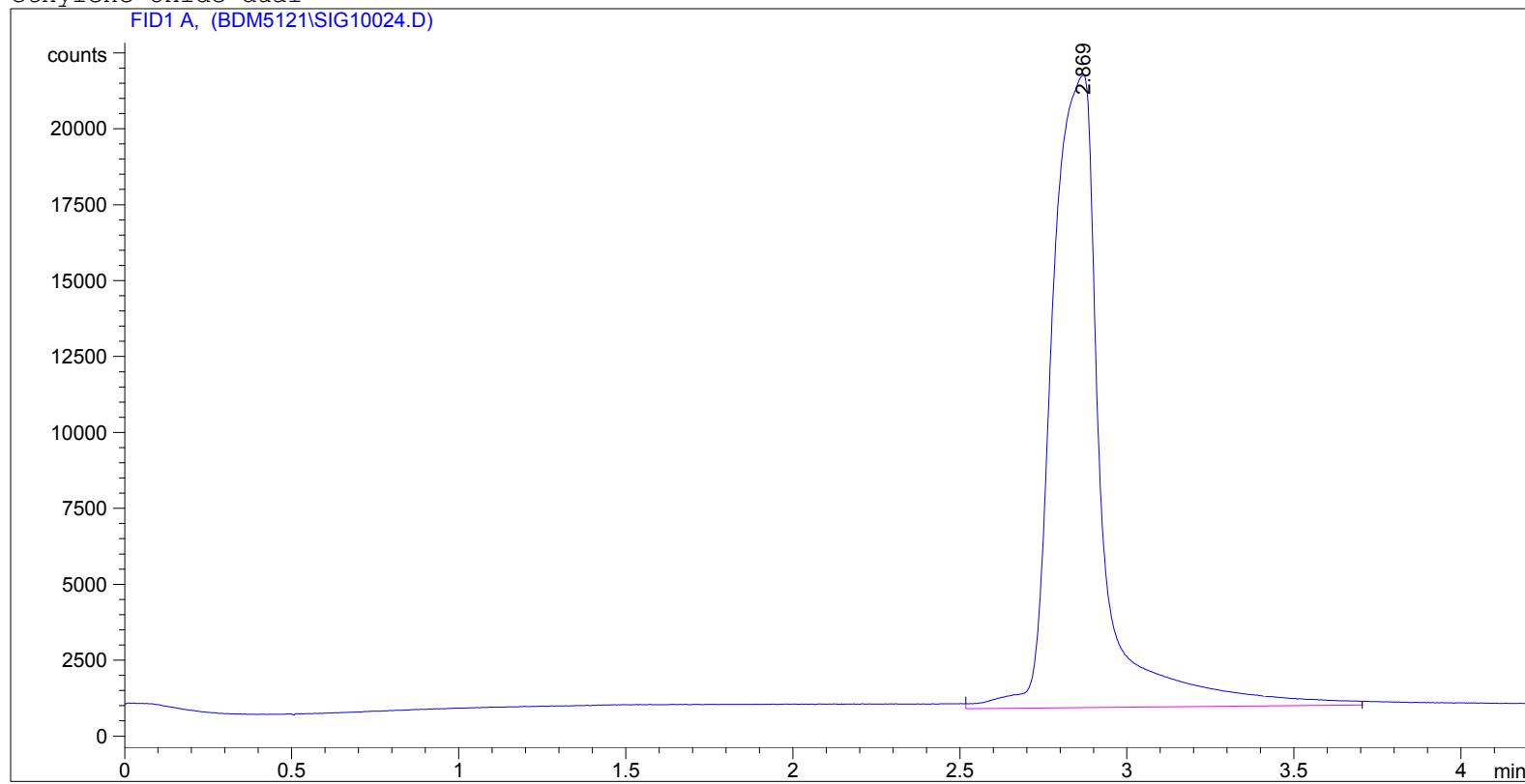
=====

\*\*\* End of Report \*\*\*

EO Outlet Line Loss 51ppm

=====

Injection Date : 7/30/2015 11:57:32 AM  
Sample Name : Out Line Loss Location : Vial 1  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.869	VV	0.1349	2.14212e5	2.08409e4	1.000e2

Totals : 2.14212e5 2.08409e4

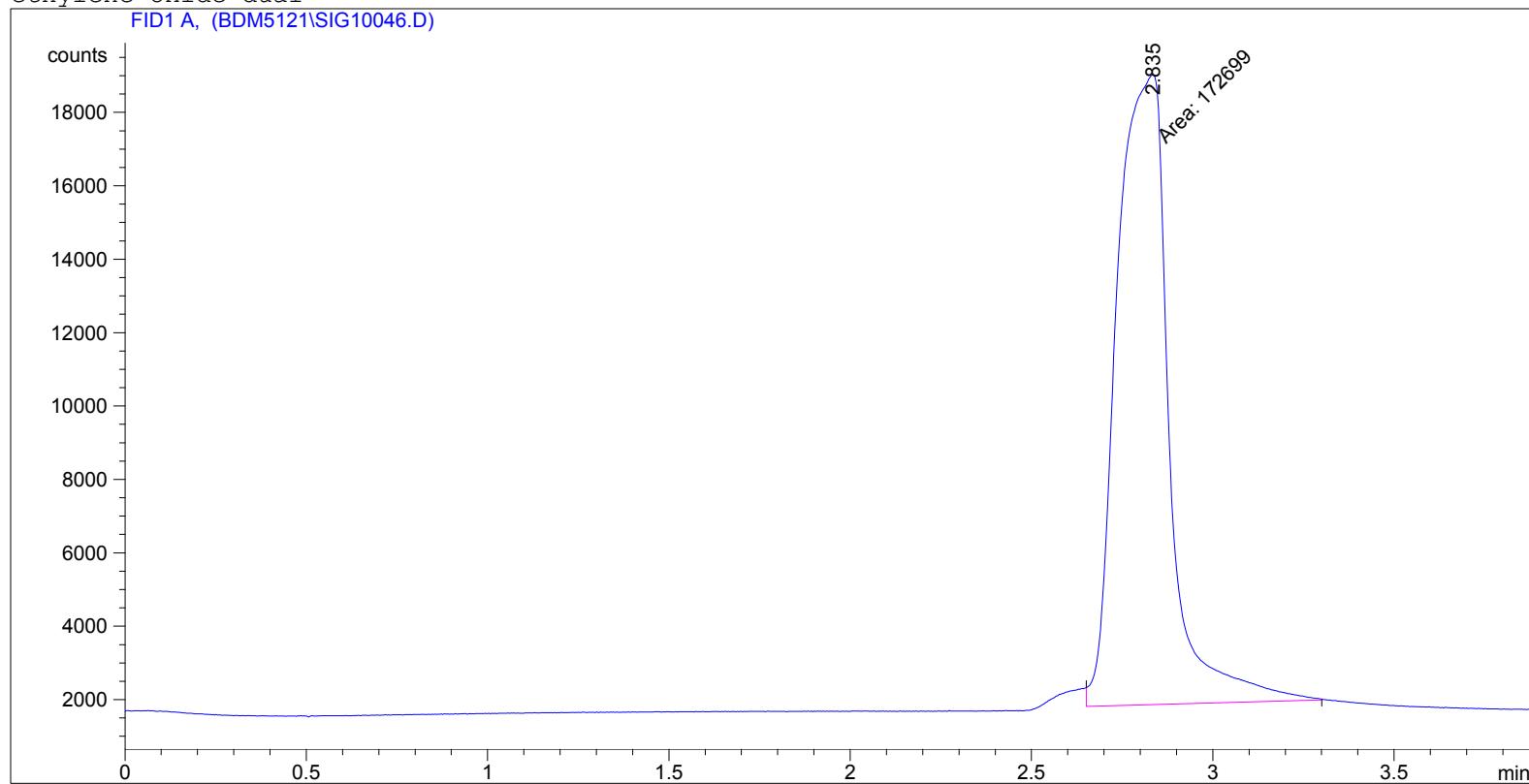
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Run 3, Inj 5

```
=====
Injection Date : 7/31/2015 12:19:48 PM
Sample Name : Out Run 3, Inj 5
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.835	FM	0.1678	1.72699e5	1.71570e4	1.000e2

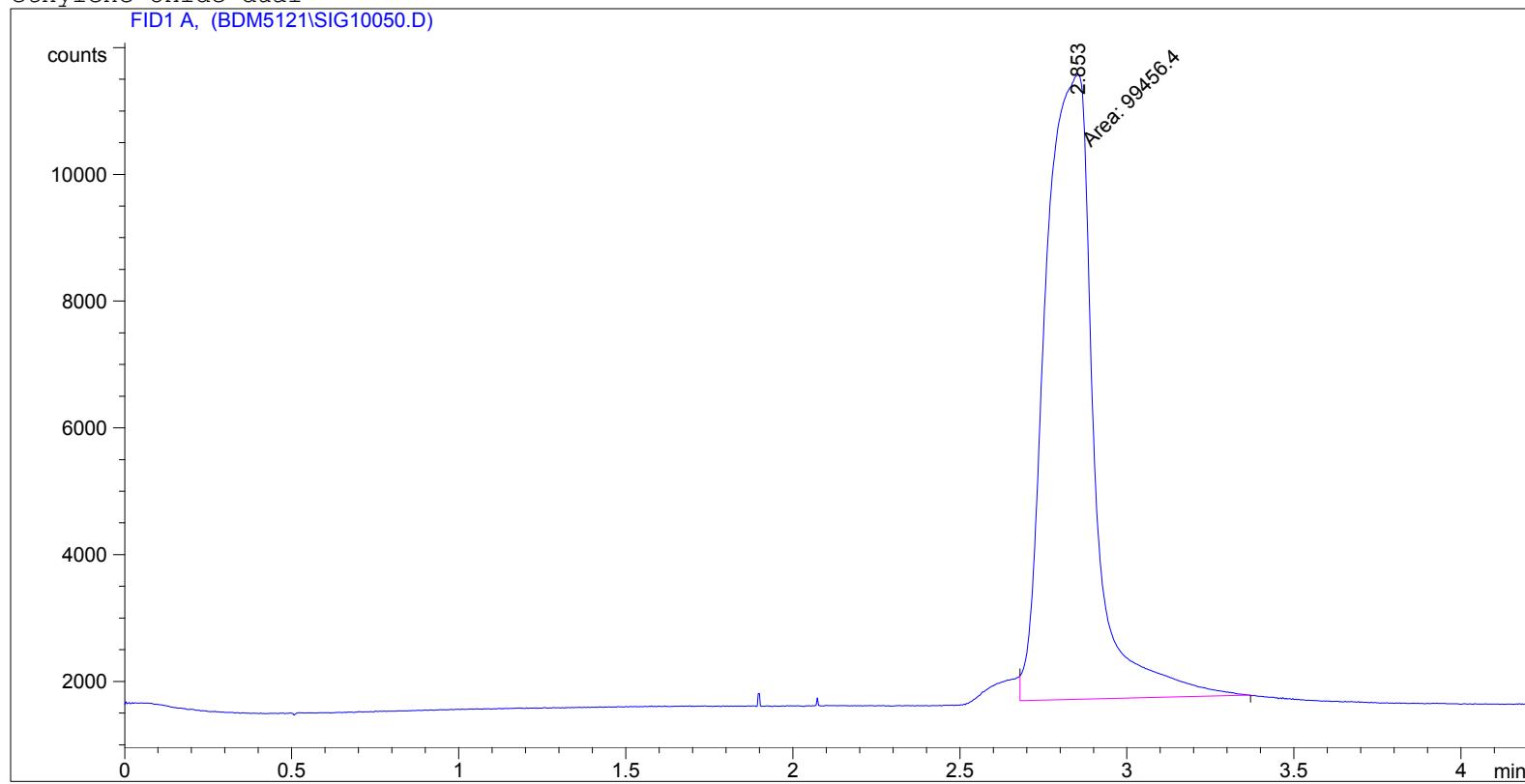
Totals : 1.72699e5 1.71570e4

Results obtained with enhanced integrator!

=====  
\*\*\* End of Report \*\*\*

EO OutletPost-Cal 12.88ppm

```
=====
Injection Date : 7/31/2015 12:48:47 PM
Sample Name : Out Post-Cal
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.853	FM	0.1682	9.94564e4	9853.25391	1.000e2

Totals : 9.94564e4 9853.25391

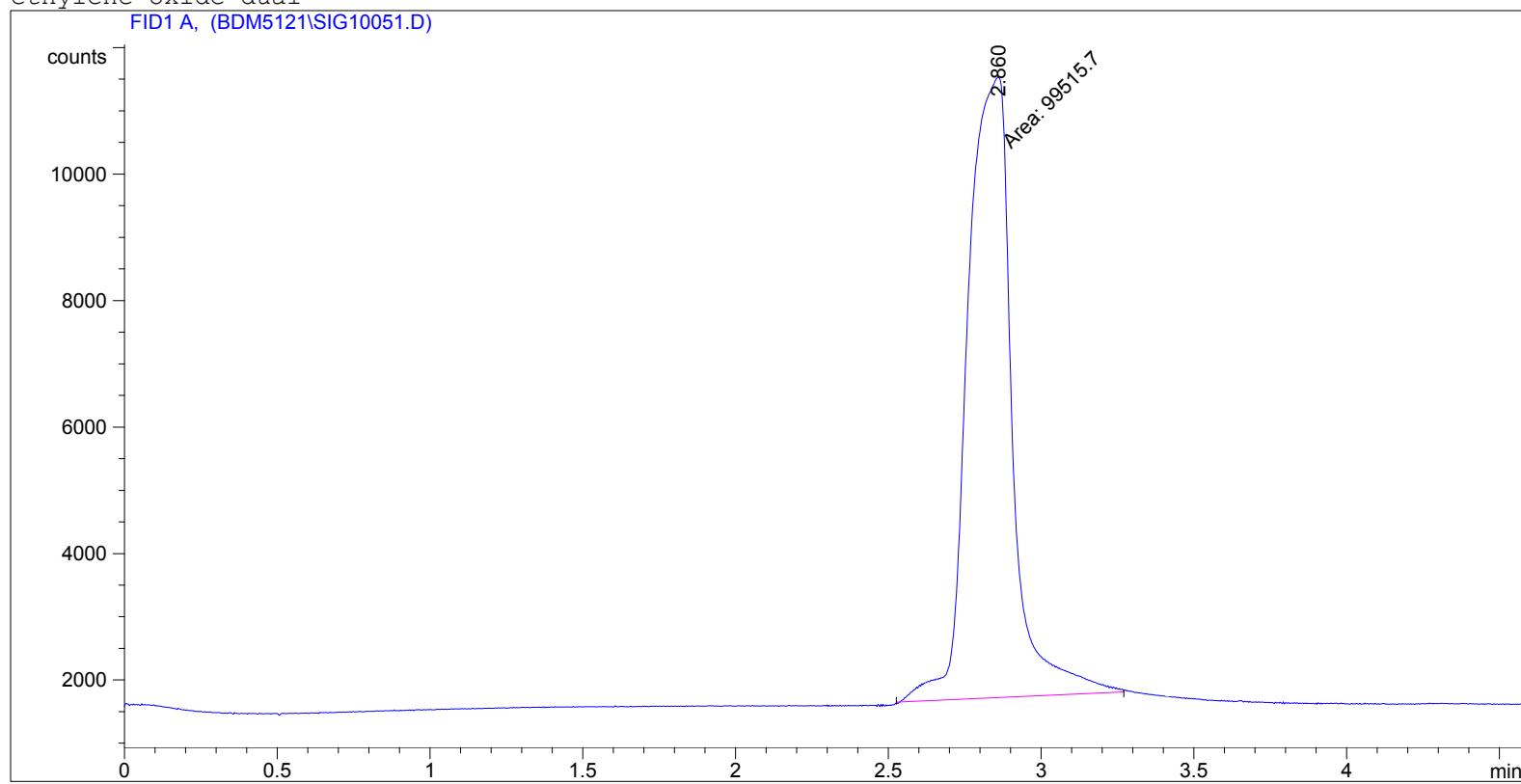
Results obtained with enhanced integrator!

=====  
\*\*\* End of Report \*\*\*

EO OutletPost-Cal 12.88ppm

=====

Injection Date : 7/31/2015 12:58:13 PM  
Sample Name : Out Post-Cal Location : Vial 1  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.860	MM	0.1689	9.95157e4	9819.00391	1.000e2

Totals : 9.95157e4 9819.00391

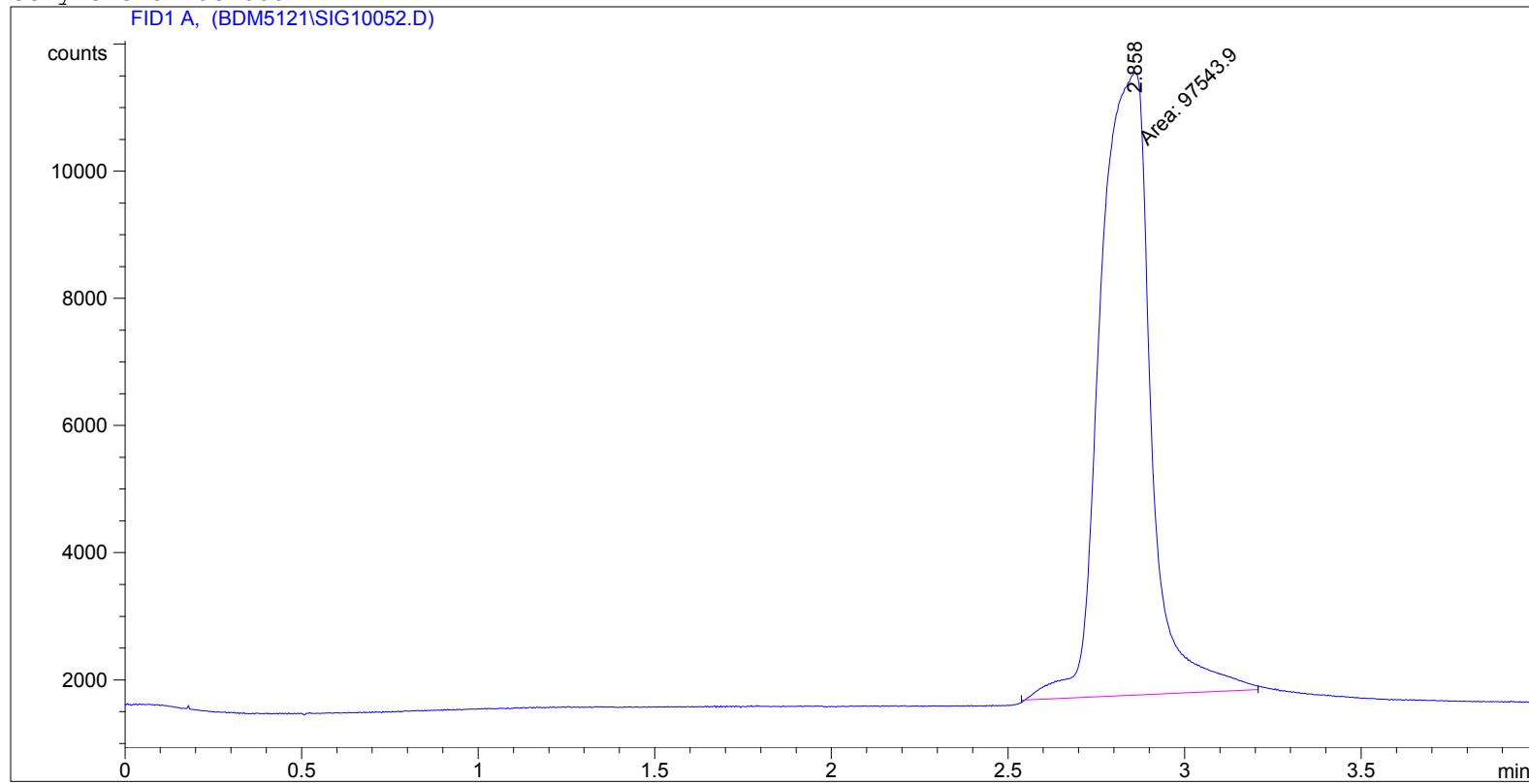
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO OutletPost-Cal 12.88ppm

```
=====
Injection Date : 7/31/2015 1:03:09 PM
Sample Name : Out Post-Cal
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width MM	Area counts*s	Height [counts]	Area %
1	2.858	MM	0.1661	9.75439e4	9788.04004	1.000e2

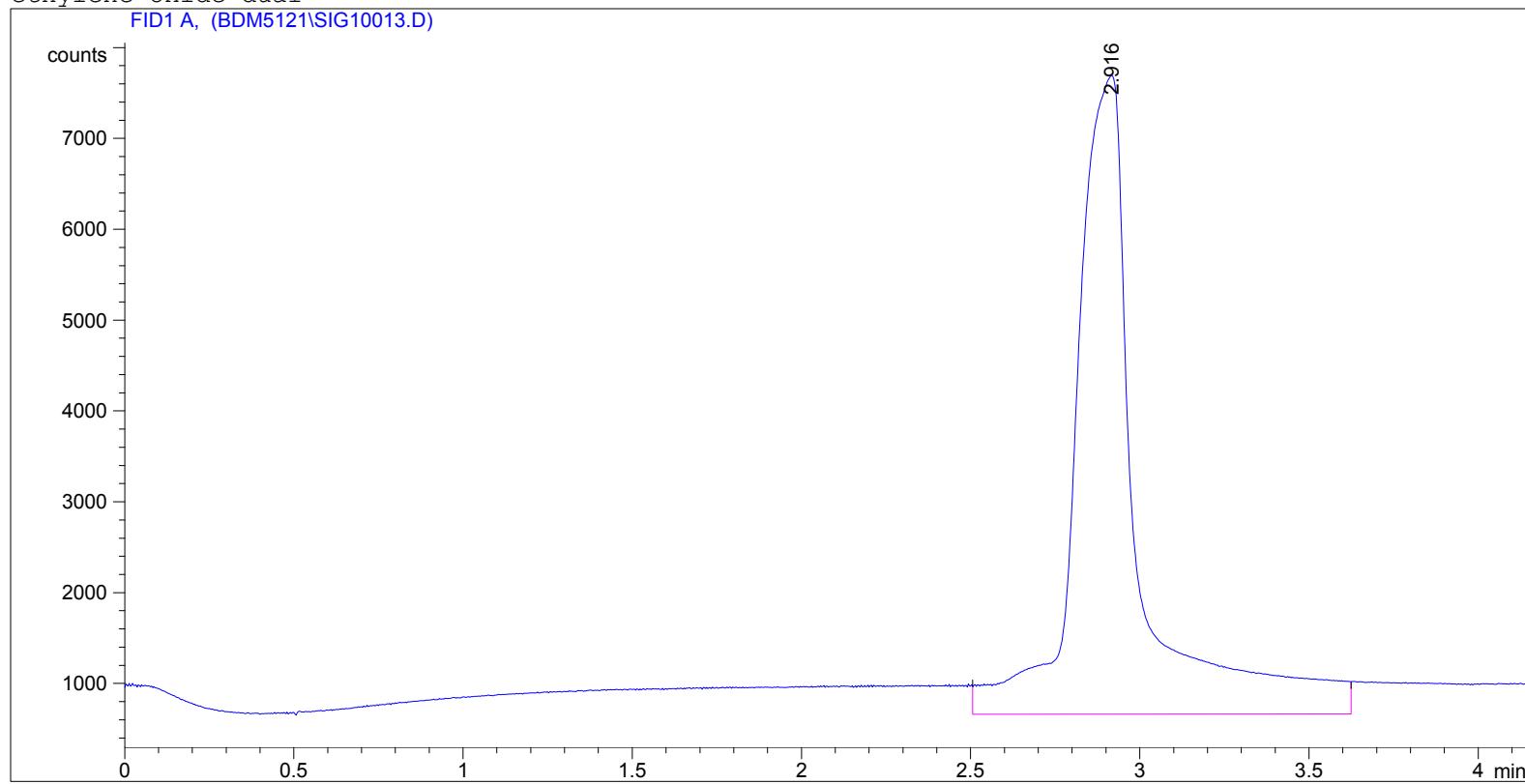
Totals : 9.75439e4 9788.04004

Results obtained with enhanced integrator!

=====  
\*\*\* End of Report \*\*\*

EO Outlet Pre-Cal 12ppm

```
=====
Injection Date : 7/30/2015 10:29:14 AM
Sample Name : Out 12ppm
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.916	VV	0.1660	8.98977e4	7038.11914	1.000e2

Totals : 8.98977e4 7038.11914

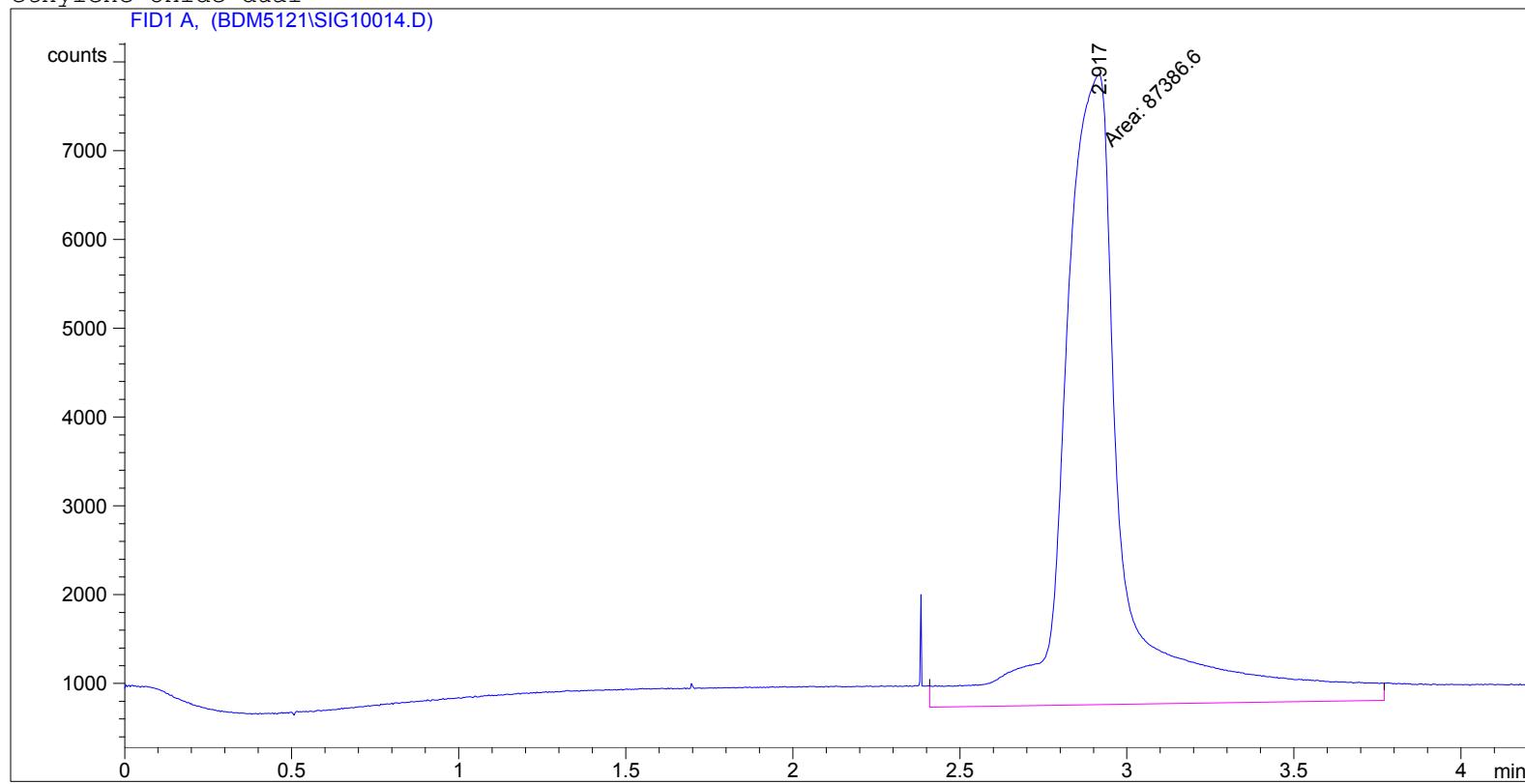
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Pre-Cal 12ppm

```
=====
Injection Date : 7/30/2015 10:36:28 AM
Sample Name : Out 12ppm
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width MM	Area counts*s	Height [counts]	Area %
1	2.917	MM	0.2053	8.73866e4	7092.51855	1.000e2

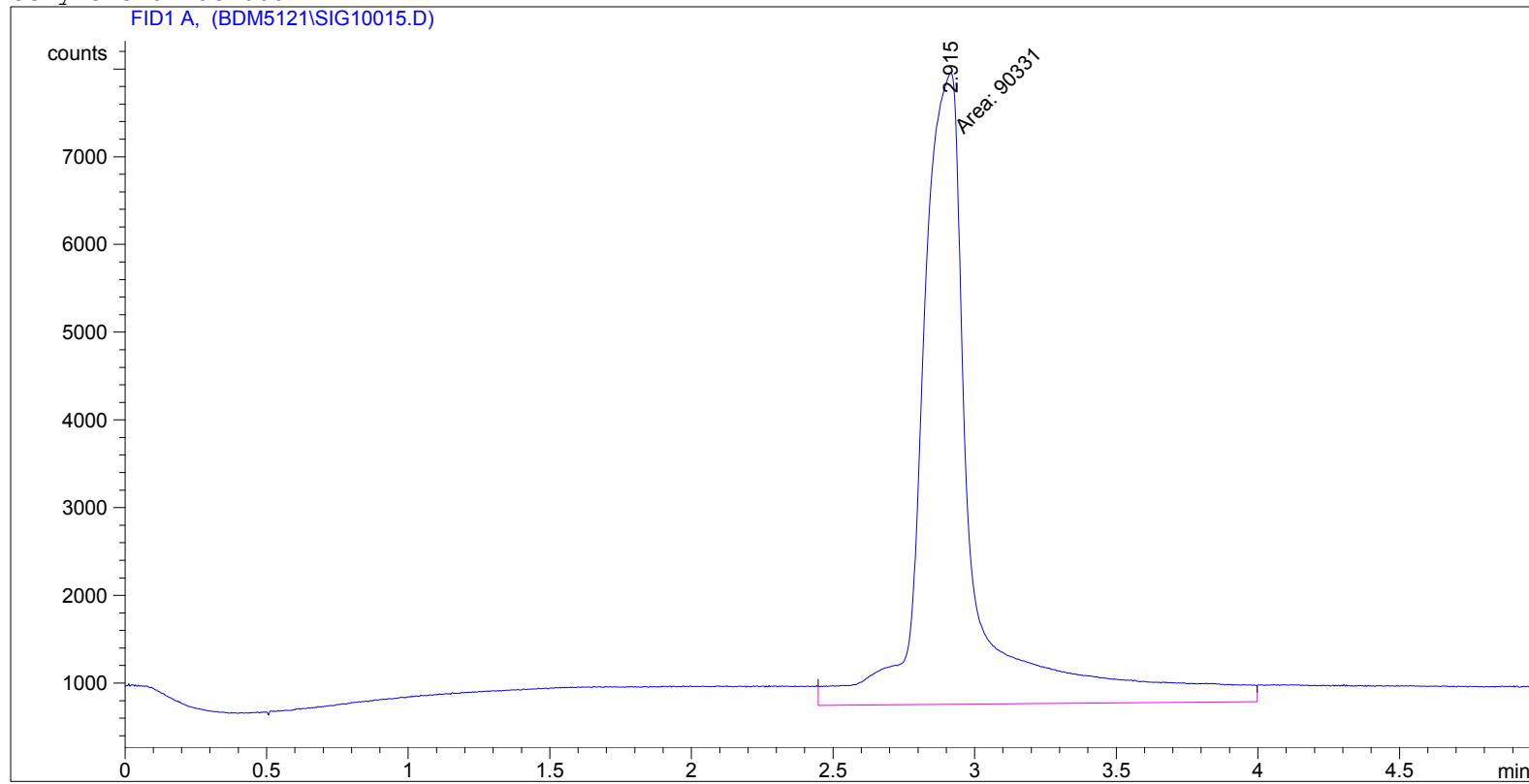
Totals : 8.73866e4 7092.51855

Results obtained with enhanced integrator!

=====  
\*\*\* End of Report \*\*\*

EO Outlet Pre-Cal 12ppm

```
=====
Injection Date : 7/30/2015 10:41:08 AM
Sample Name : Out 12ppm
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width MM	Area counts*s	Height [counts]	Area %
1	2.915	MM	0.2092	9.03310e4	7195.23779	1.000e2

Totals : 9.03310e4 7195.23779

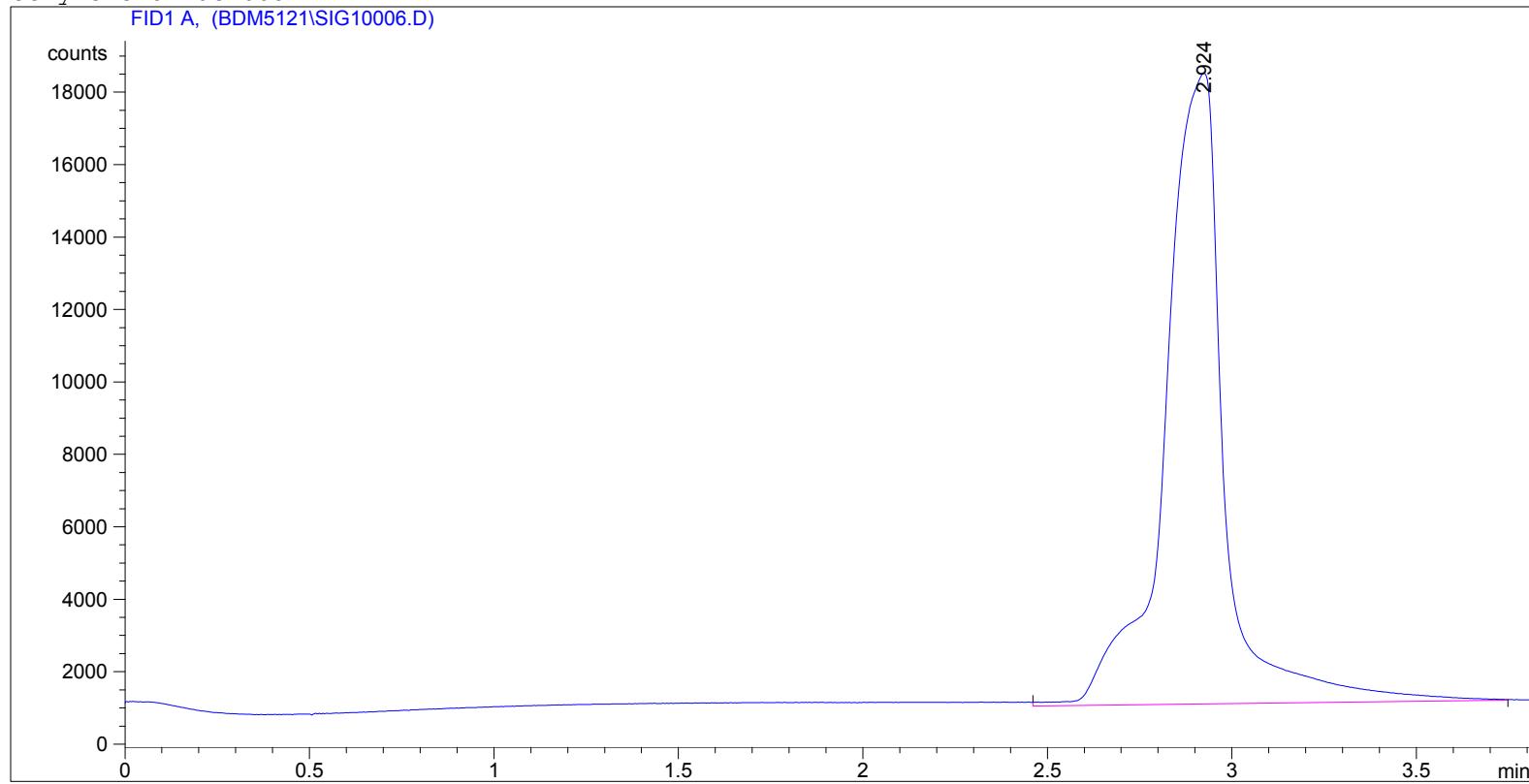
Results obtained with enhanced integrator!

=====  
\*\*\* End of Report \*\*\*

EO Outlet Pre-Cal 25ppm

=====

Injection Date : 7/30/2015 9:07:47 AM  
Sample Name : Out 25ppm Location : Vial 1  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.924	VV	0.1465	1.94887e5	1.74168e4	1.000e2

Totals : 1.94887e5 1.74168e4

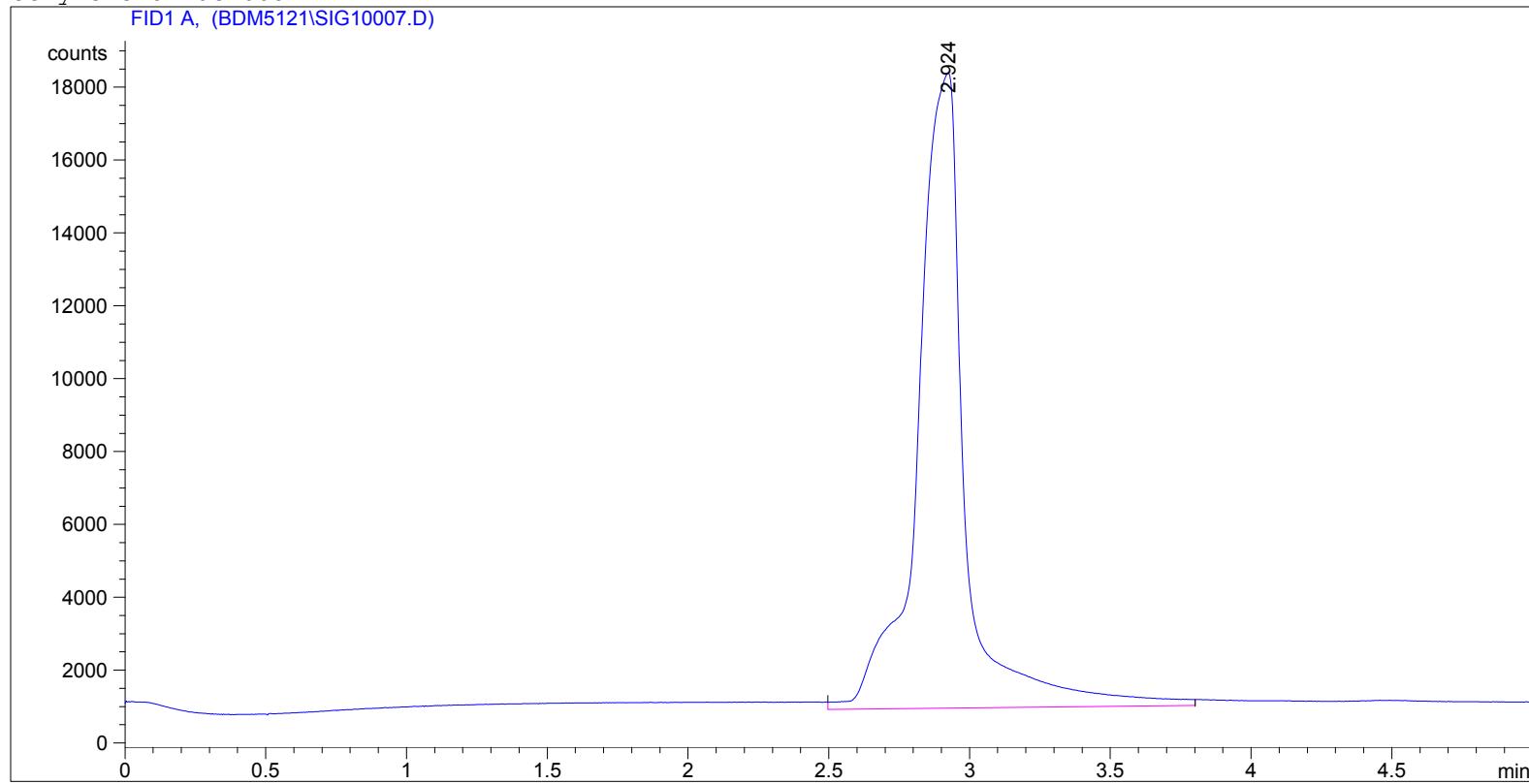
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Pre-Cal 25ppm

```
=====
Injection Date : 7/30/2015 9:16:41 AM
Sample Name : Out 25ppm
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.924	VV	0.1515	2.03879e5	1.74256e4	1.000e2

Totals : 2.03879e5 1.74256e4

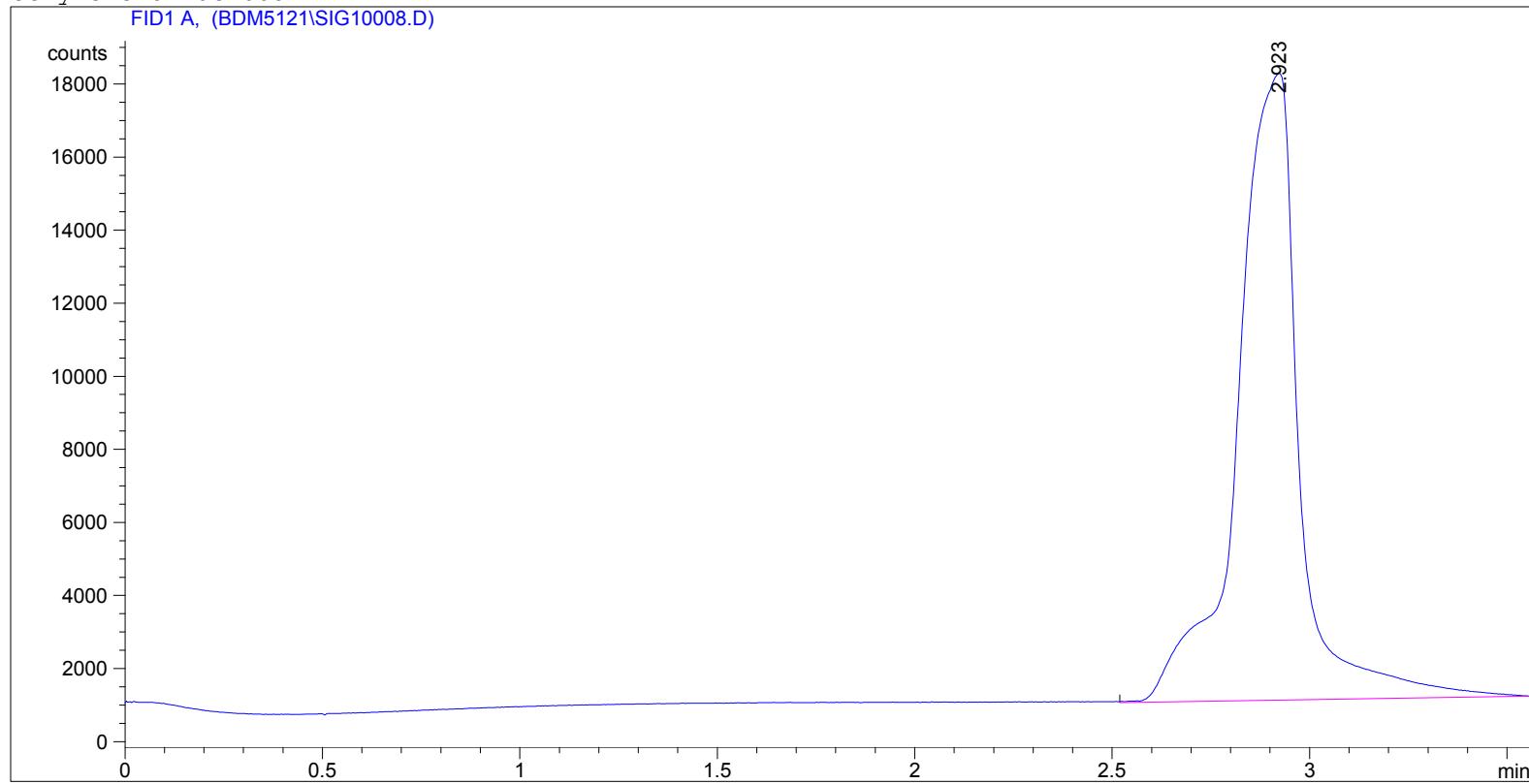
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Pre-Cal 25ppm

```
=====
Injection Date : 7/30/2015 9:30:53 AM
Sample Name : Out 25ppm
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.923	VBA	0.1427	1.86394e5	1.71608e4	1.000e2

Totals : 1.86394e5 1.71608e4

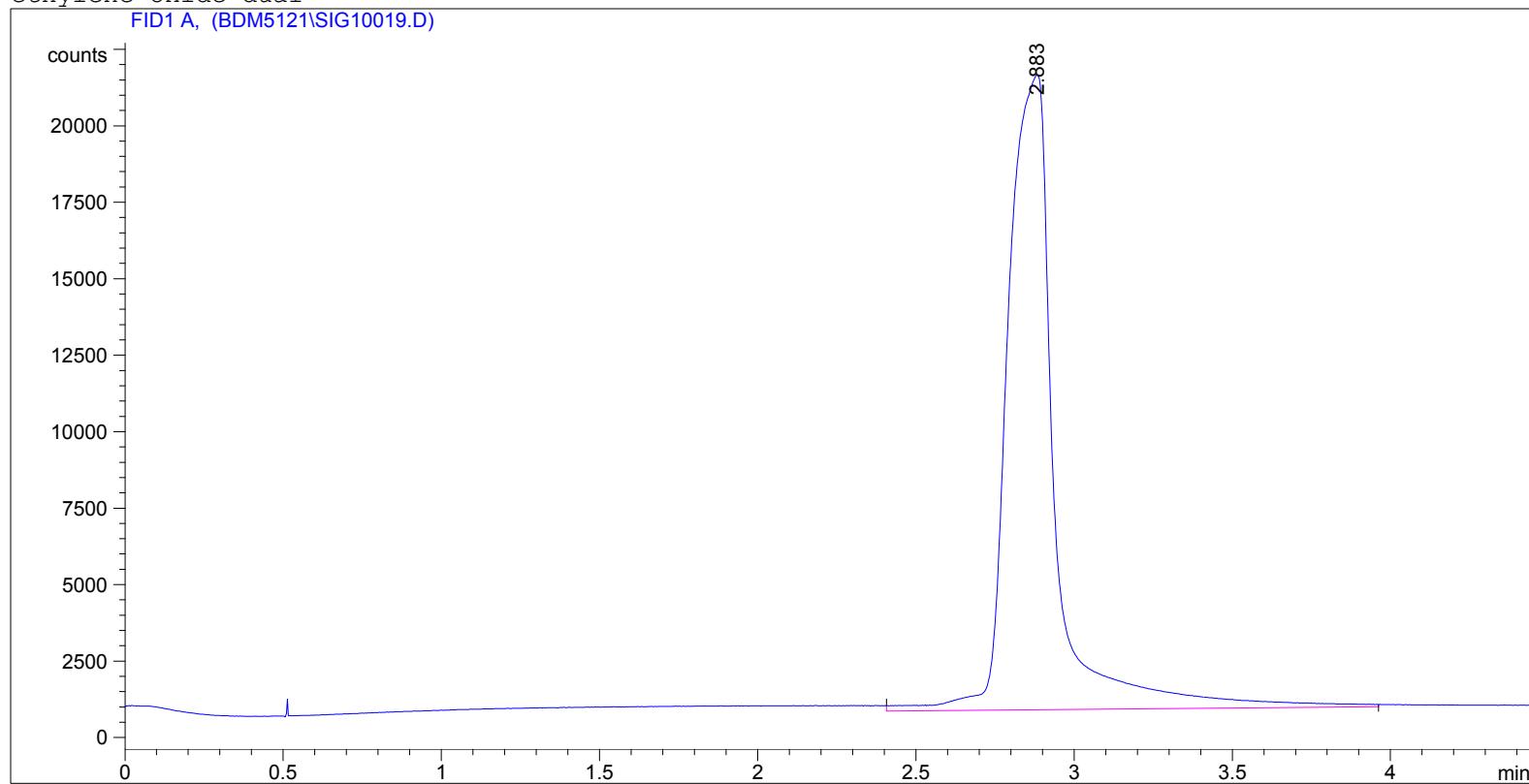
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Pre-Cal 51ppm For Line Loss

```
=====
Injection Date : 7/30/2015 11:26:56 AM
Sample Name : Out Pre Cal 51
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.883	VV	0.1371	2.15384e5	2.07479e4	1.000e2

Totals : 2.15384e5 2.07479e4

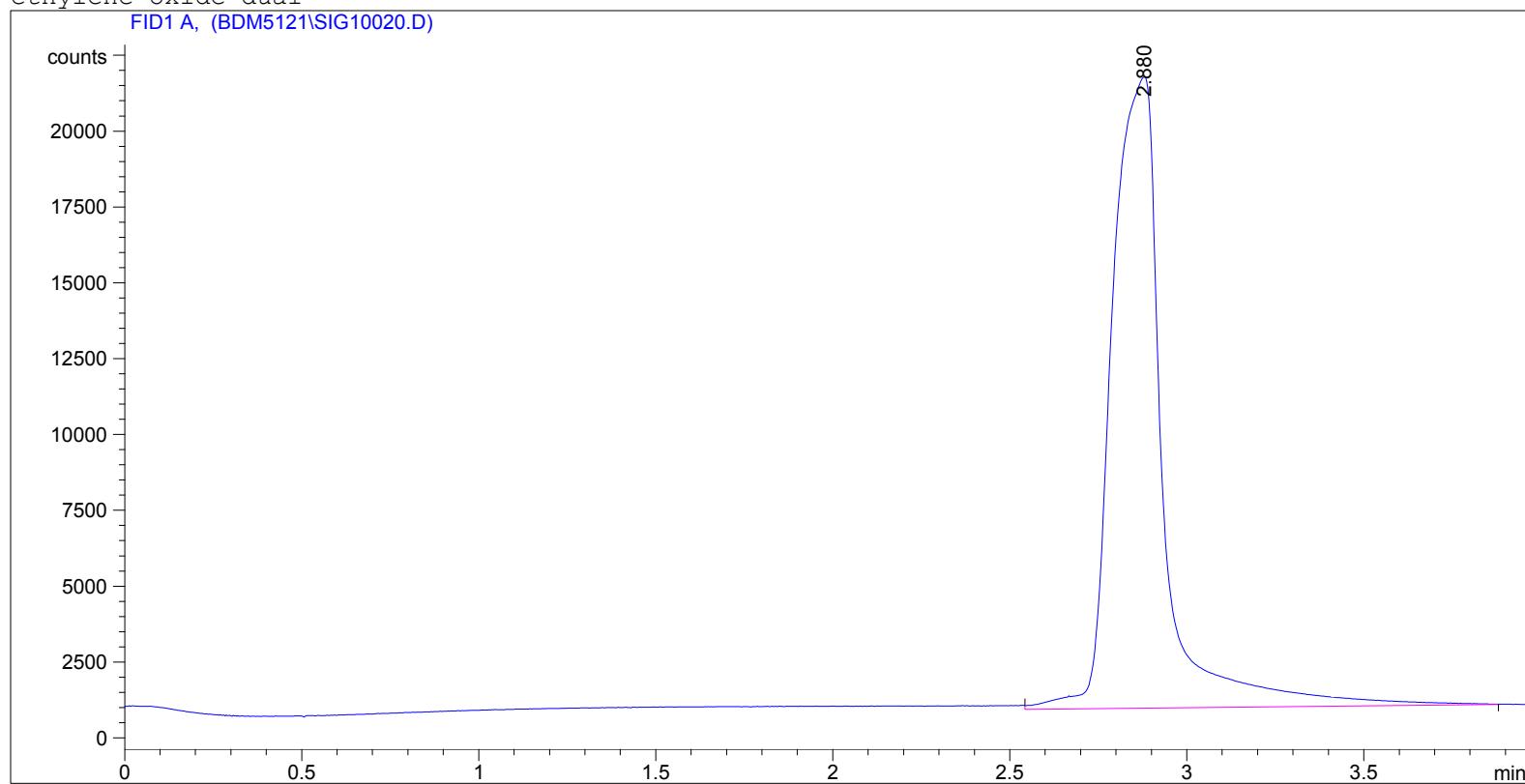
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Pre-Cal 51ppm For Line Loss

```
=====
Injection Date : 7/30/2015 11:33:30 AM
Sample Name : Out Pre Cal 51
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.880	VB	0.1338	2.10091e5	2.08140e4	1.000e2

Totals : 2.10091e5 2.08140e4

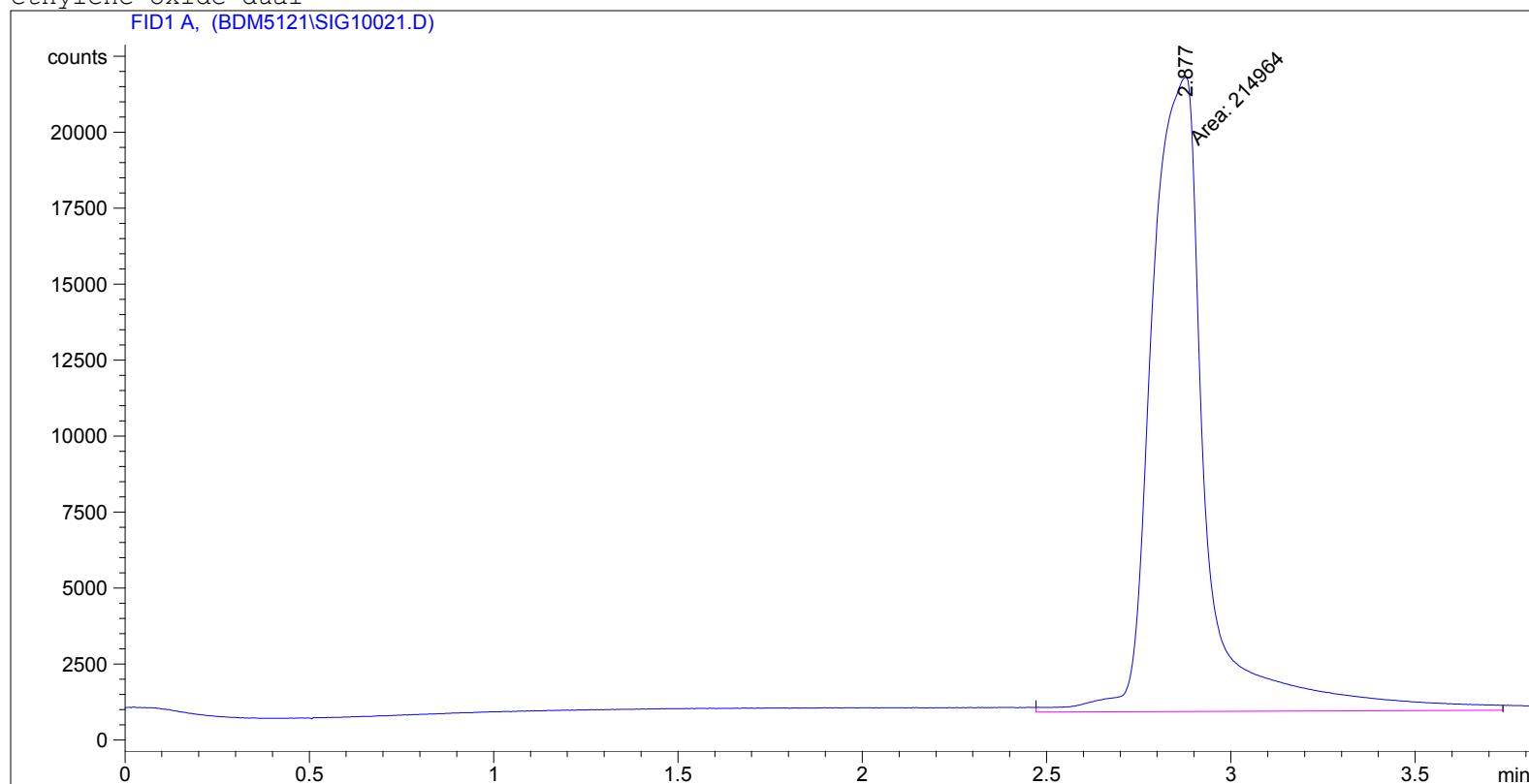
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Outlet Pre-Cal 51ppm For Line Loss

```
=====
Injection Date : 7/30/2015 11:38:03 AM
Sample Name : Out Pre Cal 51
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width MM	Area counts*s	Height [counts]	Area %
1	2.877	MM	0.1716	2.14964e5	2.08768e4	1.000e2

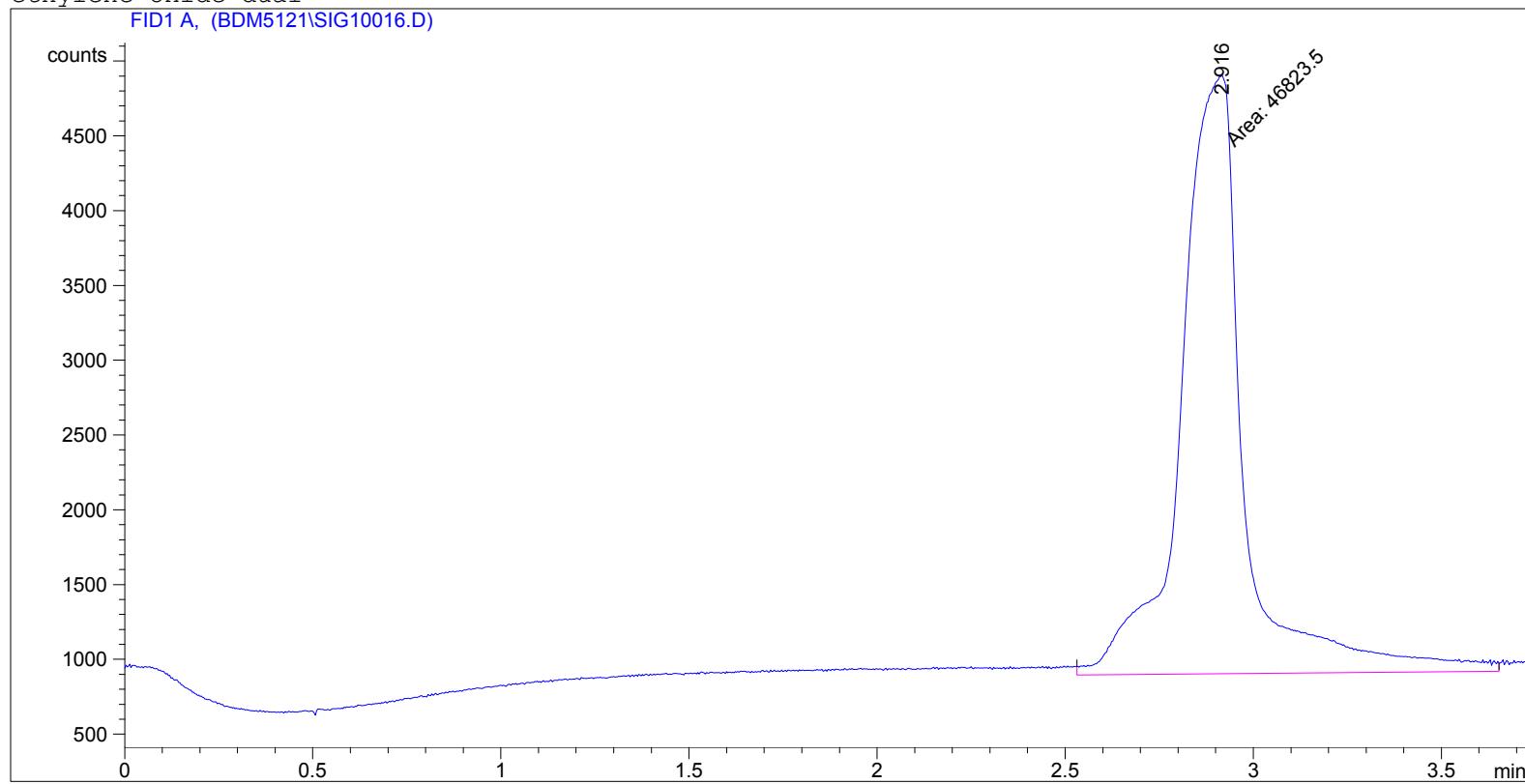
Totals : 2.14964e5 2.08768e4

Results obtained with enhanced integrator!

=====  
\*\*\* End of Report \*\*\*

EO Outlet Pre-Cal 6ppm

```
=====
Injection Date : 7/30/2015 10:46:47 AM
Sample Name : Out 6ppm
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.916	MM	0.1949	4.68235e4	4004.58105	1.000e2

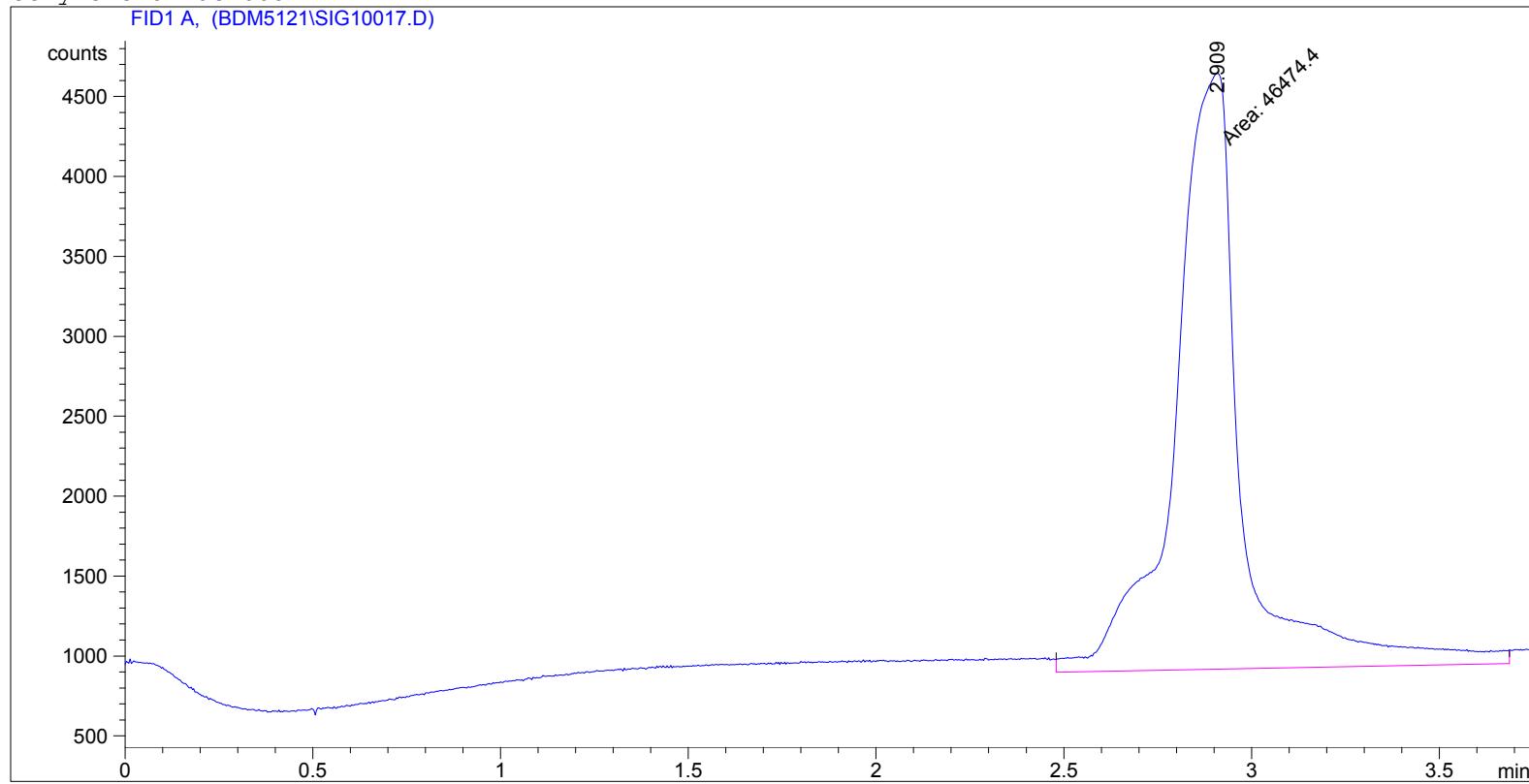
Totals : 4.68235e4 4004.58105

Results obtained with enhanced integrator!

=====  
\*\*\* End of Report \*\*\*

EO Outlet Pre-Cal 6ppm

```
=====
Injection Date : 7/30/2015 10:54:27 AM
Sample Name : Out 6ppm
Location : Vial 1
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

Peak #	RetTime [min]	Type	Width MM	Area counts*s	Height [counts]	Area %
1	2.909	MM	0.2077	4.64744e4	3729.10132	1.000e2

Totals : 4.64744e4 3729.10132

Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

## **Inlet Data**

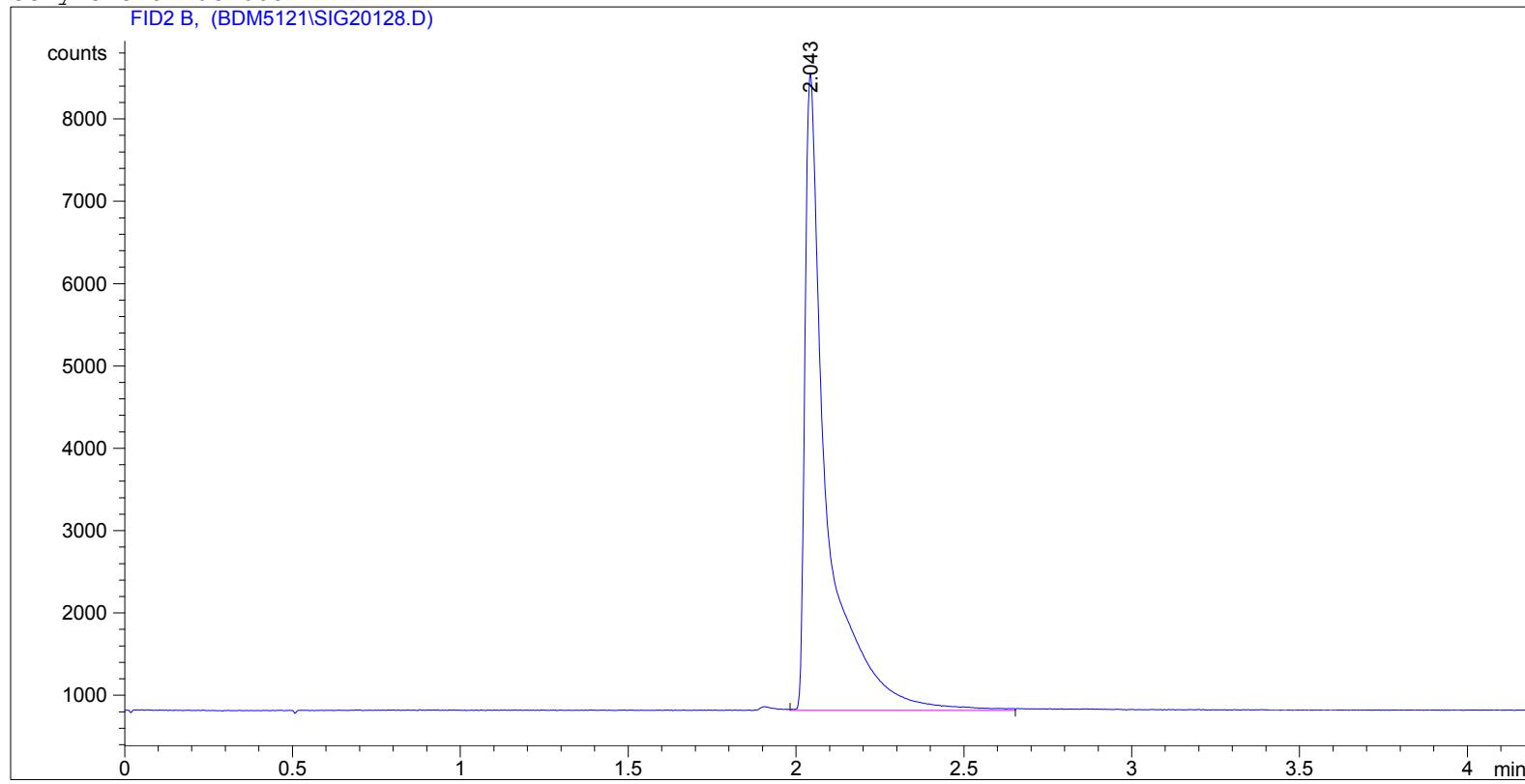
8-8  
89

Air Pollution Testing Inc. : EPA Method 2 - Pitot Traverse Datasheet									
Job # :	3BDM S021	Operator :	Logan Coote	Stack Diameter (inches) :	23.5				
Facility :	3BDM coast	Site :	DPM East+	Upstream Disturbance (inches) :	~20"				
Date :	7/31/17	Points :	1 4.9 5 19.9 9 2 6.5 6 22.9 10 3 8.6 7 25 11 4 11.6 8 26.7 12	Downstream Disturbance (inches) :	12"				
Probe ID :	P-867	Schematic of Sampling Location :		Schematic of Sampling Location :					
Pitot Constant :	.938	Pocd = 4"		Pocd = 4"					
Pitot Tube Visual Check:	/	Run # : 212		Run # : 312					
Run # : 11N	O2% : CO2% : CDAS measured / estimate	CO2% : CDAS measured / estimate	CO2% : CDAS measured / estimate	CO2% : CDAS measured / estimate	CO2% : CDAS measured / estimate				
O2% : CDAS measured / estimate	H2O% : Ps ("H2O) : Start Time : 10:08	CDAS measured / estimate	H2O% : Ps ("H2O) : Start Time : 10:45	CDAS measured / estimate	H2O% : Ps ("H2O) : Start Time : 10:51	CDAS measured / estimate	H2O% : Ps ("H2O) : Start Time : 12:35	CDAS measured / estimate	H2O% : Ps ("H2O) : Start Time : 12:41
H2O% : Ps ("H2O) : Start Time : 10:08	Pb (mbar) : Stop Time : 10:08	Pb (mbar) : Stop Time : 10:45	Pb (mbar) : Stop Time : 10:51	Pb (mbar) : Stop Time : 12:35	Pb (mbar) : Stop Time : 12:41				
Post Test Pitot Leak Check Good? : 0.005" Hg	Post Test Pitot Leak Check Good? : 0.005" Hg	Post Test Pitot Leak Check Good? : 0.005" Hg	Post Test Pitot Leak Check Good? : 0.005" Hg	Post Test Pitot Leak Check Good? : 0.005" Hg	Post Test Pitot Leak Check Good? : 0.005" Hg	Post Test Pitot Leak Check Good? : 0.005" Hg	Post Test Pitot Leak Check Good? : 0.005" Hg	Post Test Pitot Leak Check Good? : 0.005" Hg	Post Test Pitot Leak Check Good? : 0.005" Hg
Point #	Delta P	Ts	Notes	Point #	Delta P	Ts	Notes	Point #	Delta P
1-1	.22	.97		1-1	.24	.98		1-1	.26
1-2	.24	.97		1-2	.24	.98		1-2	.25
1-3	.24	.98		1-3	.23	.98		1-3	.25
1-4	.22	.98		1-4	.21	.98		1-4	.21
1-5	.20	.97		1-5	.20	.98		1-5	.21
1-6	.20	.97		1-6	.19	.98		1-6	.20
1-7	.20	.97		1-7	.19	.98		1-7	.20
1-8	.20	.96		1-8	.18	.98		1-8	.19
2-1	.23	.96		2-1	.19	.98		2-1	.23
2-2	.24	.97		2-2	.20	.98		2-2	.24
2-3	.23	.97		2-3	.21	.98		2-3	.25
2-4	.21	.97		2-4	.20	.98		2-4	.25
2-5	.21	.97		2-5	.22	.98		2-5	.24
2-6	.21	.97		2-6	.22	.98		2-6	.23
2-7	.22	.96		2-7	.23	.98		2-7	.22
2-8	.22	.97		2-8	.21	.98		2-8	.19
Averages :		46.9		45.2	100.5			47.0	104.38
Reviewers Signature :									

EO Inlet Run 1, Inj 1, Oven temp 45, Aux 100, 10 uL loo  
p

=====

Injection Date : 7/31/2015 8:29:00 AM  
Sample Name : IN Run 1, Inj 1 Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.043	VV	0.0628	3.43940e4	7741.74219	1.000e2

Totals : 3.43940e4 7741.74219

Results obtained with enhanced integrator!

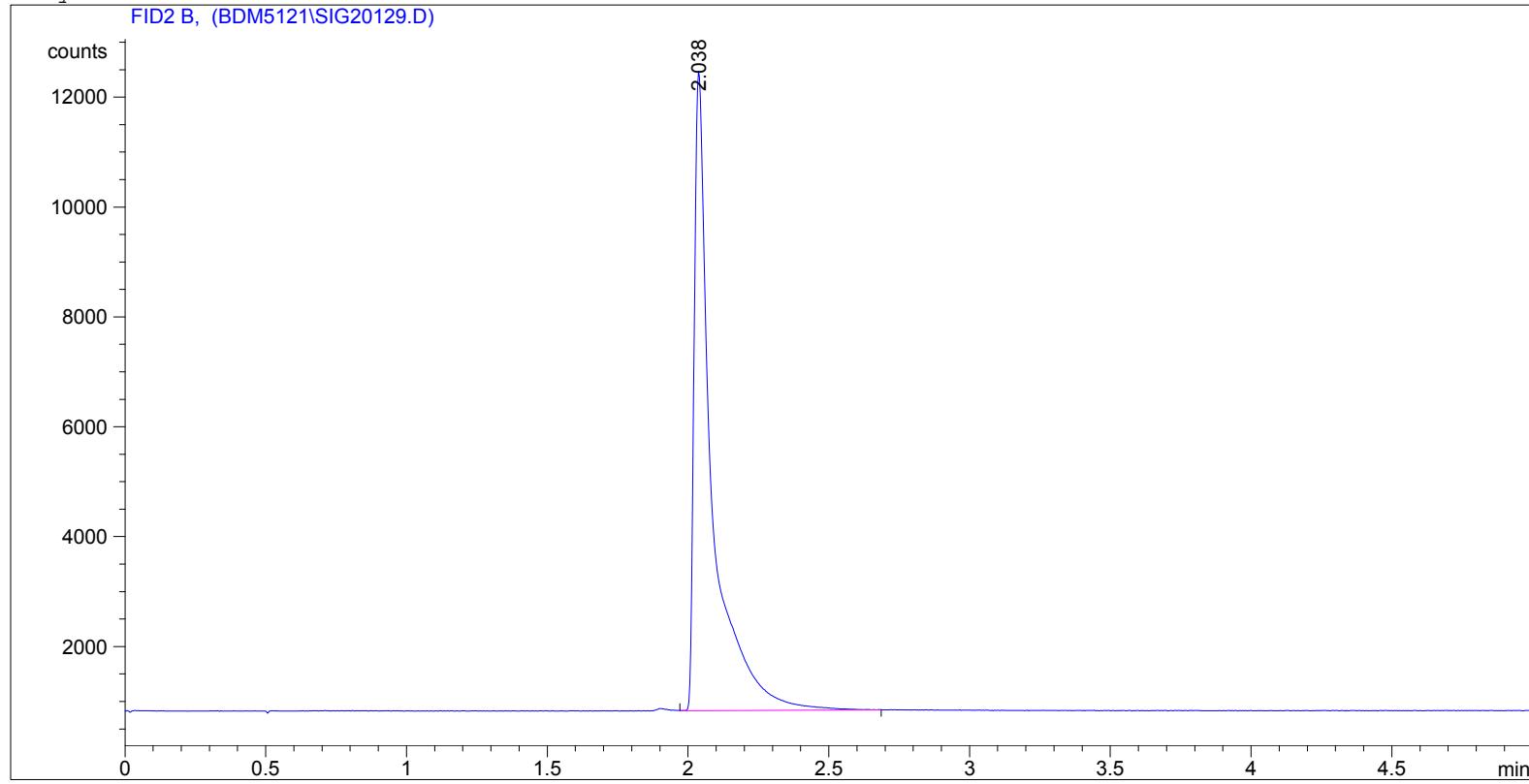
=====

\*\*\* End of Report \*\*\*

EO Inlet Run 1, Inj 2, Oven temp 45, Aux 100, 10 uL loo  
p

=====

Injection Date : 7/31/2015 8:38:12 AM  
Sample Name : IN Run 1, Inj 2 Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.038	VB	0.0613	5.12466e4	1.16613e4	1.000e2

Totals : 5.12466e4 1.16613e4

Results obtained with enhanced integrator!

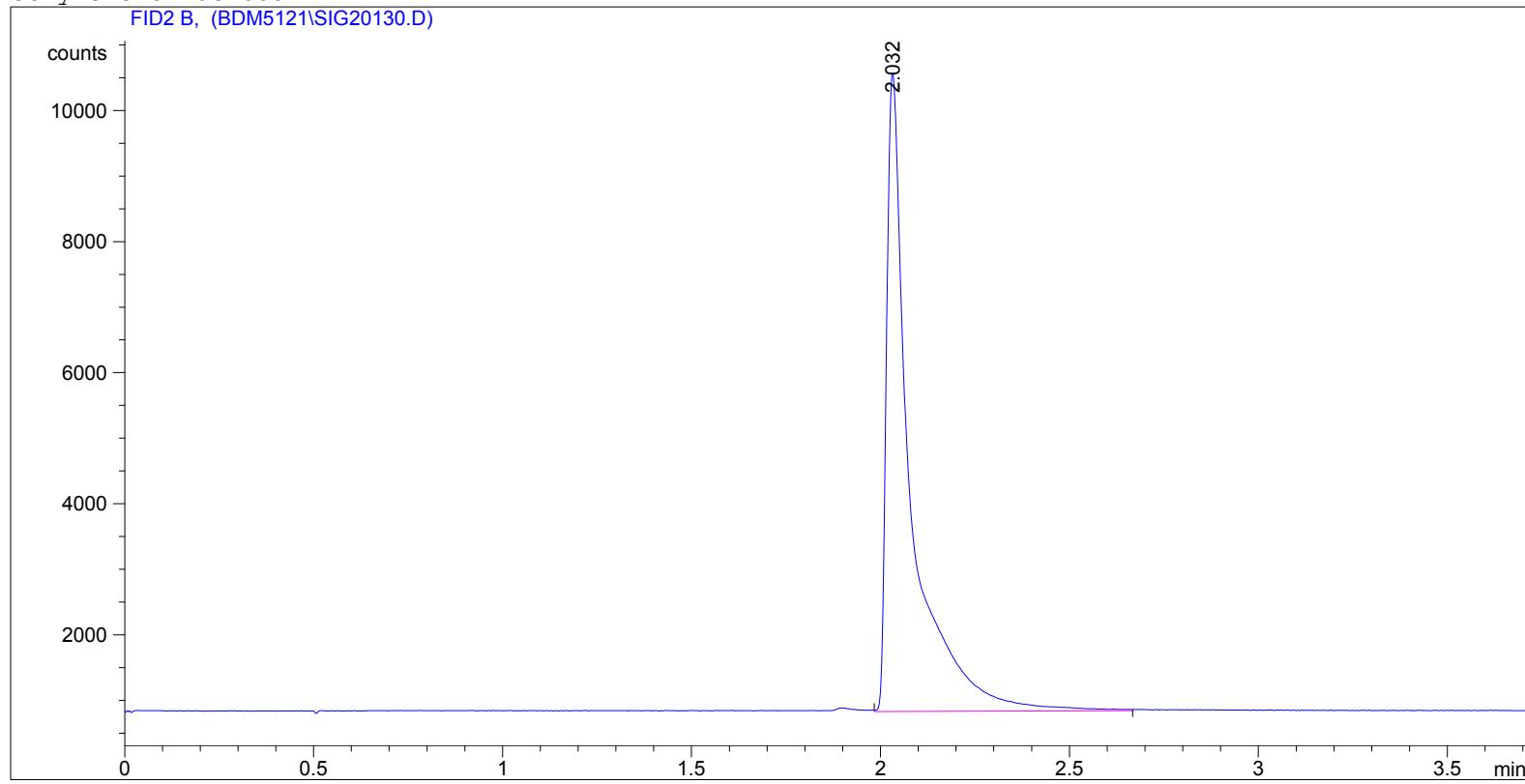
=====

\*\*\* End of Report \*\*\*

EO Inlet Run 1, Inj 3, Oven temp 45, Aux 100, 10 uL loo  
p

=====

Injection Date : 7/31/2015 8:48:22 AM  
Sample Name : IN Run 1, Inj 3 Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.032	VV	0.0620	4.35066e4	9759.94727	1.000e2

Totals : 4.35066e4 9759.94727

Results obtained with enhanced integrator!

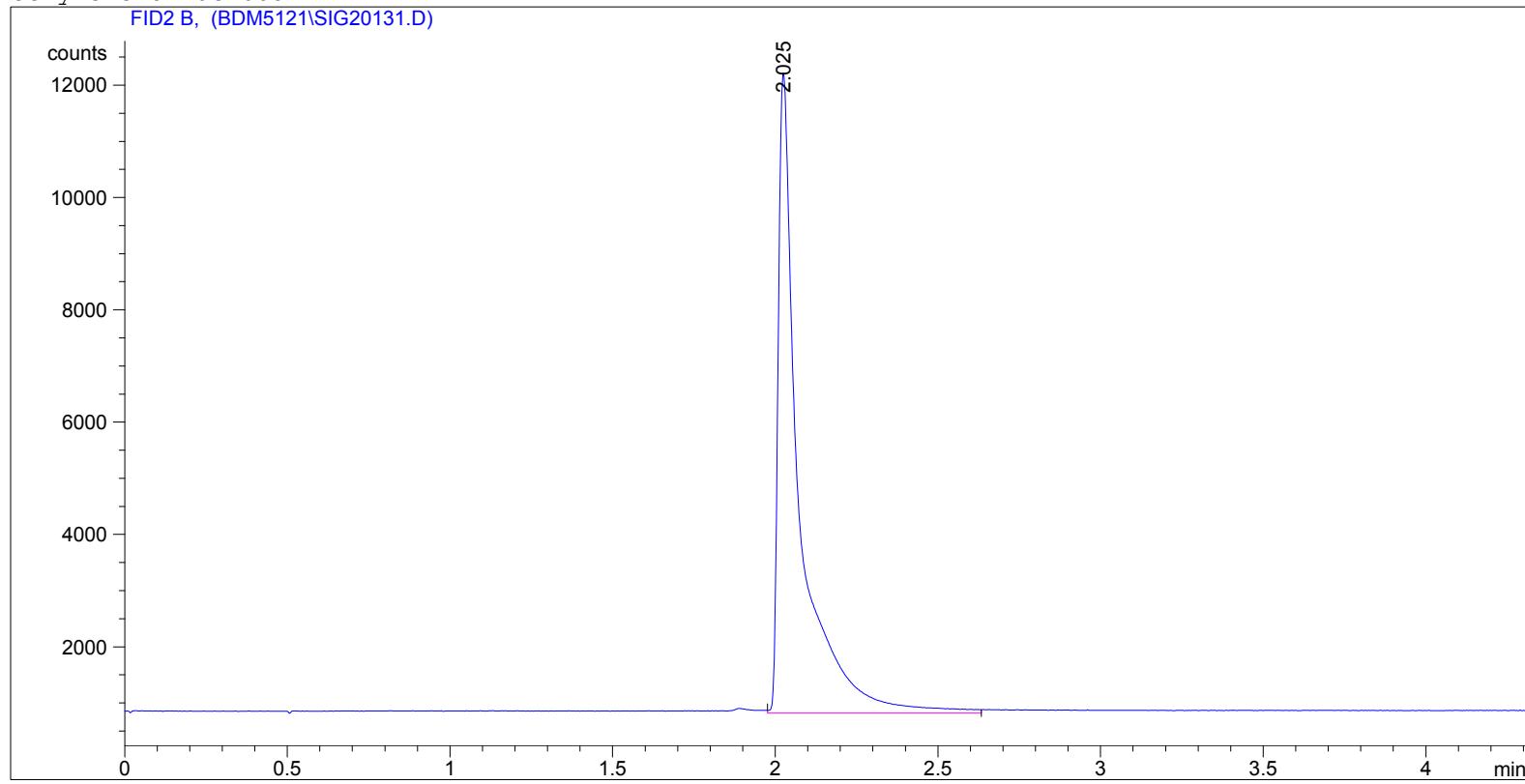
=====

\*\*\* End of Report \*\*\*

EO Inlet Run 1, Inj 4, Oven temp 45, Aux 100, 10 uL loo  
p

=====

Injection Date : 7/31/2015 8:58:29 AM  
Sample Name : IN Run 1, Inj 4 Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.025	VV	0.0626	5.16003e4	1.14400e4	1.000e2

Totals : 5.16003e4 1.14400e4

Results obtained with enhanced integrator!

=====

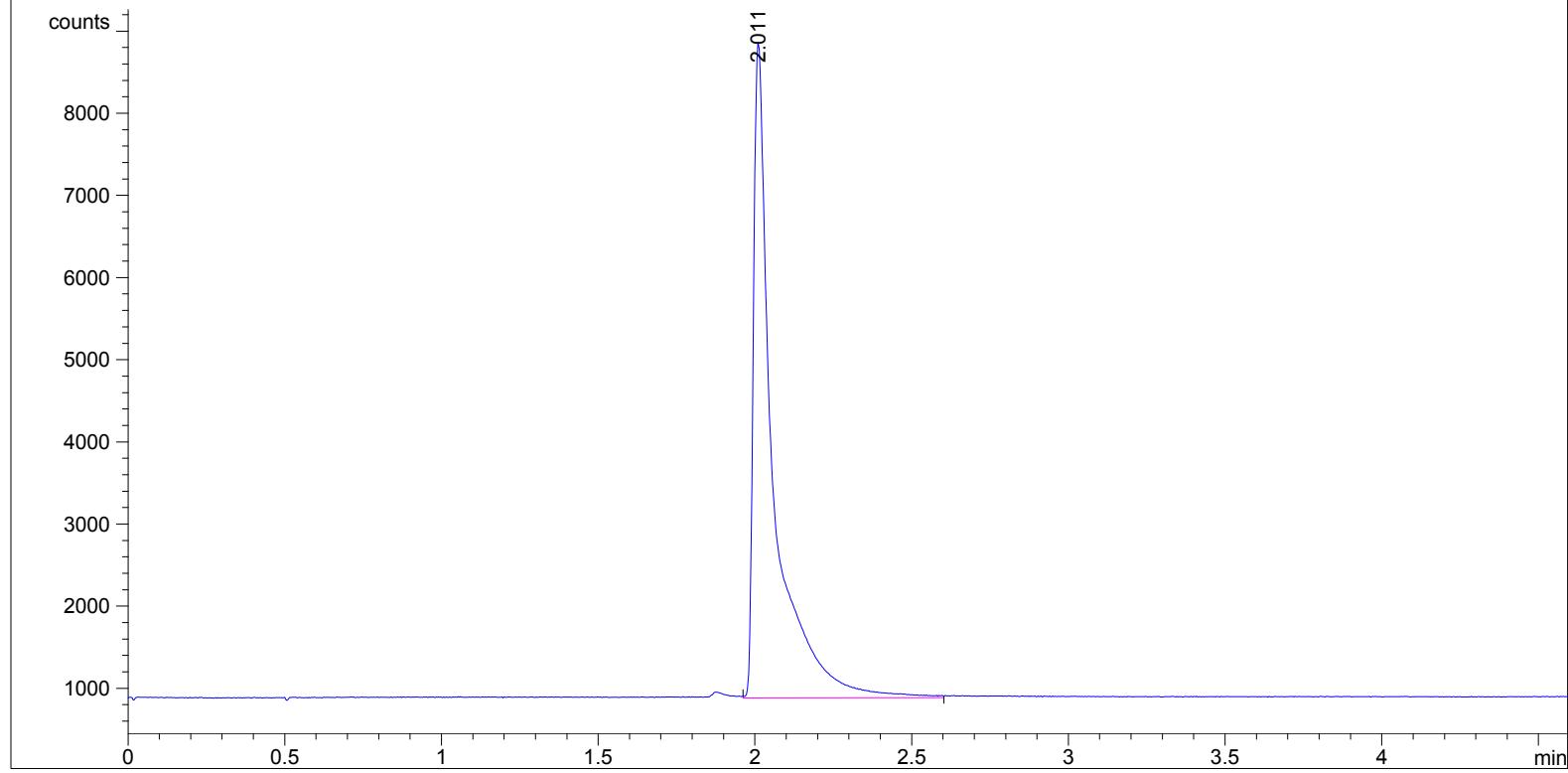
\*\*\* End of Report \*\*\*

EO Inlet Run 1, Inj 5, Oven temp 45, Aux 100, 10 uL loo  
p

=====

Injection Date : 7/31/2015 9:14:29 AM  
Sample Name : IN Run 1, Inj 5 Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual

FID2 B, (BDM5121\SIG20132.D)



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.011	VV	0.0603	3.51145e4	7989.51416	1.000e2

Totals : 3.51145e4 7989.51416

Results obtained with enhanced integrator!

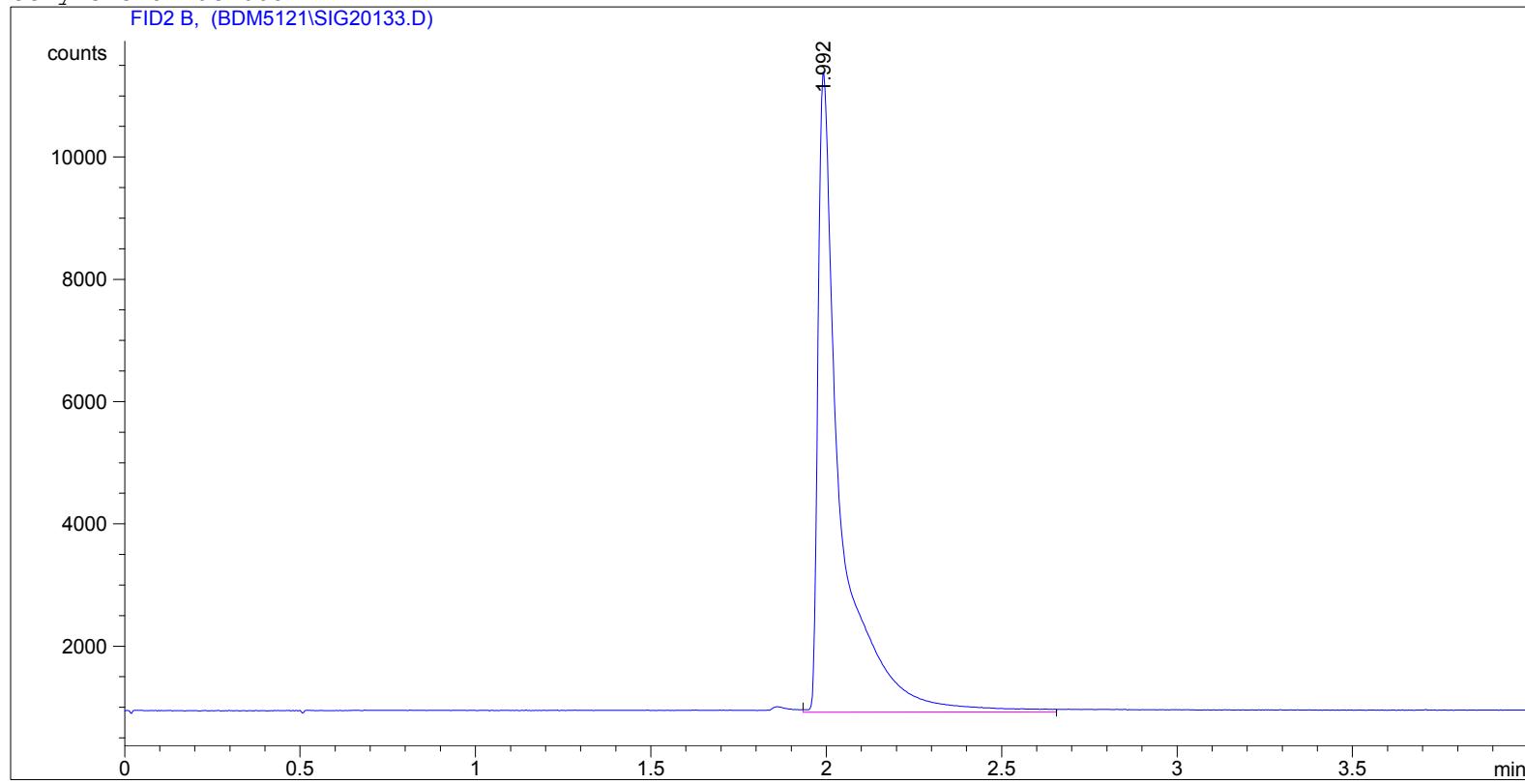
=====

\*\*\* End of Report \*\*\*

EO Inlet Run 2, Inj 1, Oven temp 45, Aux 100, 10 uL loo  
p

=====

Injection Date : 7/31/2015 9:48:35 AM  
Sample Name : IN Run 2, Inj 1 Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	1.992	VV	0.0617	4.64361e4	1.04740e4	1.000e2

Totals : 4.64361e4 1.04740e4

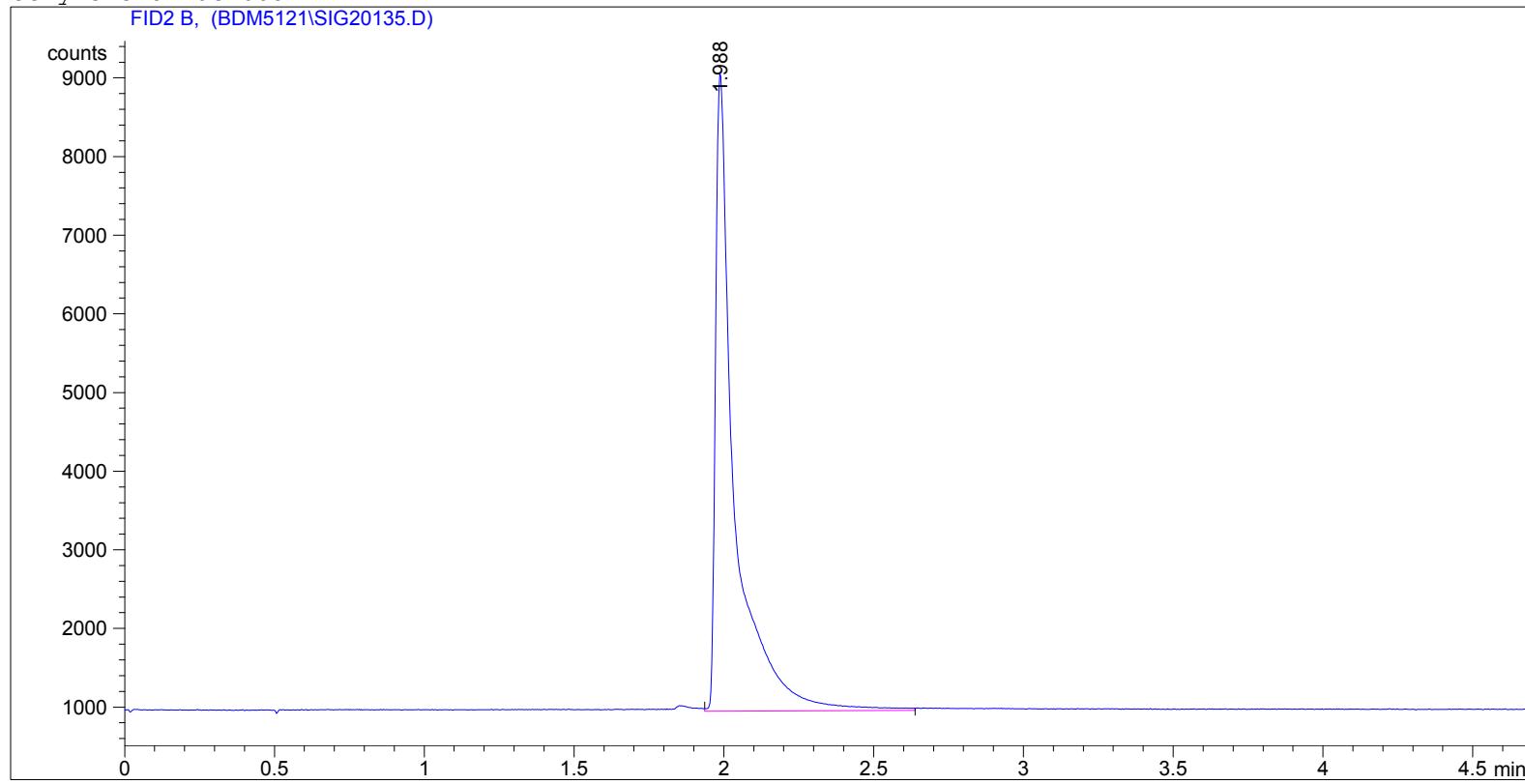
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Inlet Run 2, Inj 2, Oven temp 45, Aux 100, 10 uL loo  
p

```
=====
Injection Date : 7/31/2015 10:01:28 AM
Sample Name : IN Run 2, Inj 2
Location : Vial 2
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	1.988	VV	0.0602	3.57432e4	8137.76904	1.000e2

Totals : 3.57432e4 8137.76904

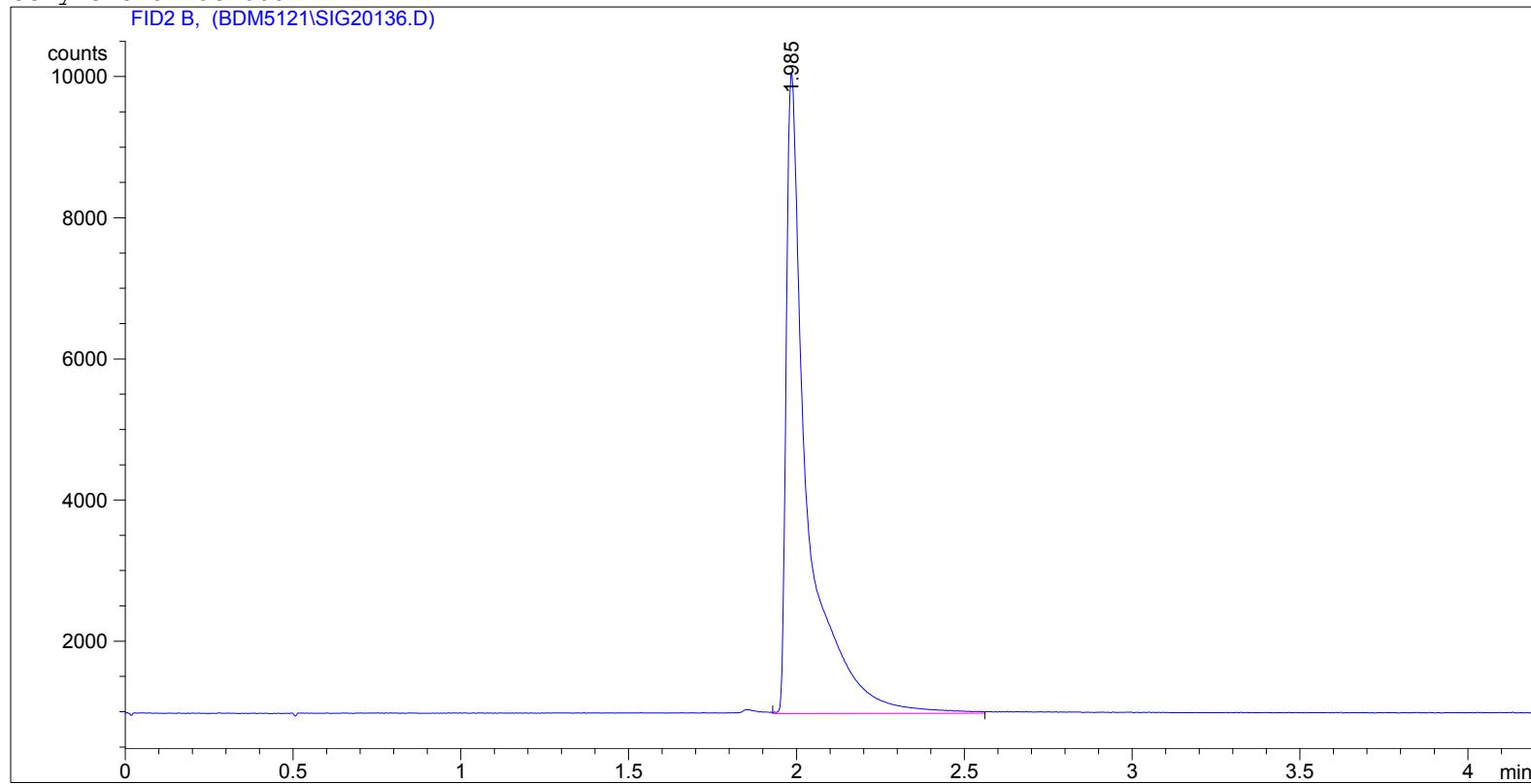
Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet Run 2, Inj 2, Oven temp 45, Aux 100, 10 uL loo  
p

=====

Injection Date : 7/31/2015 10:10:39 AM  
Sample Name : IN Run 2, Inj 2 Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	1.985	VV	0.0606	3.93648e4	9081.41895	1.000e2

Totals : 3.93648e4 9081.41895

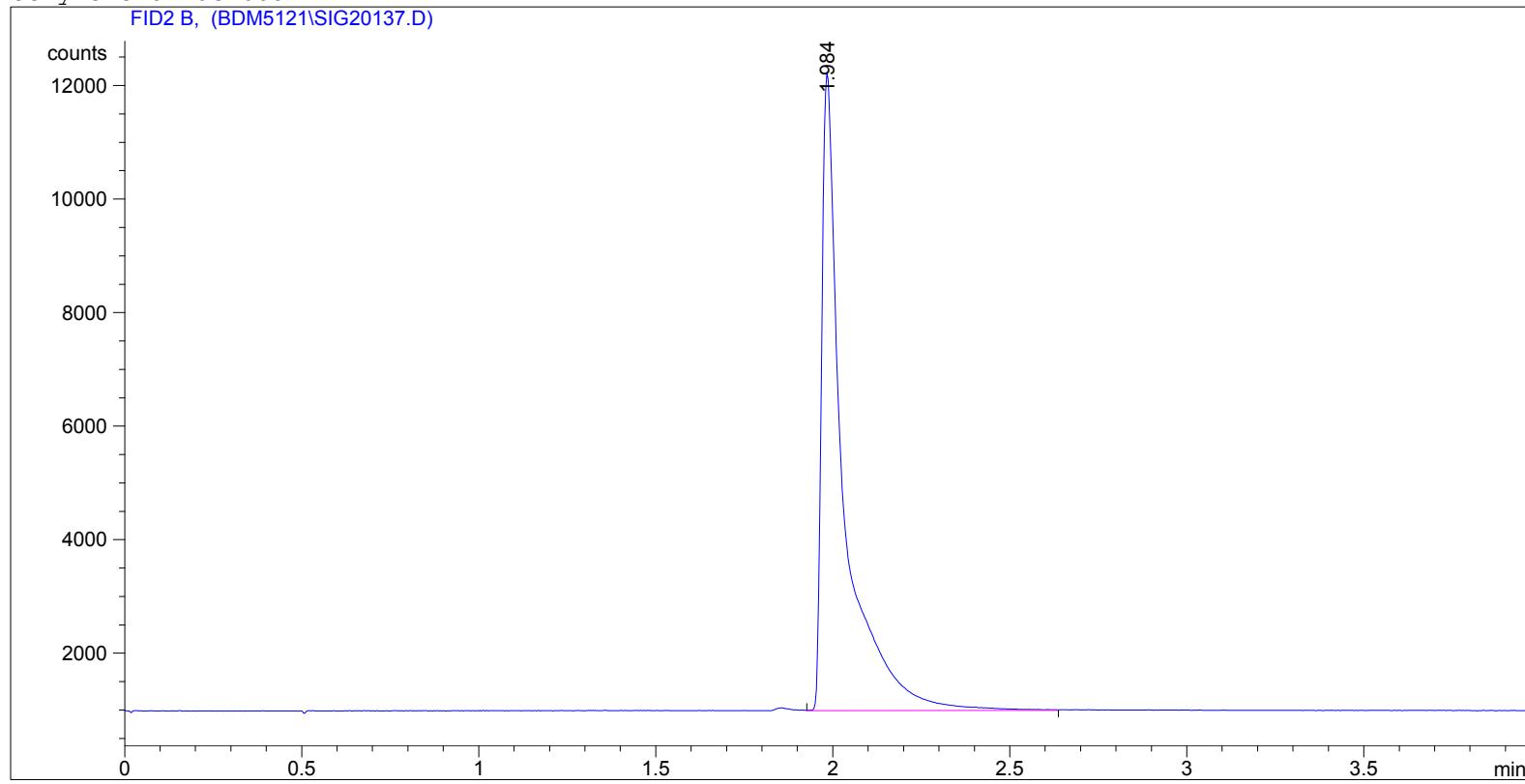
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Inlet Run 2, Inj 4, Oven temp 45, Aux 100, 10 uL loo  
p

```
=====
Injection Date : 7/31/2015 10:18:15 AM
Sample Name : IN Run 2, Inj 4
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	1.984	VV	0.0601	4.82755e4	1.12457e4	1.000e2

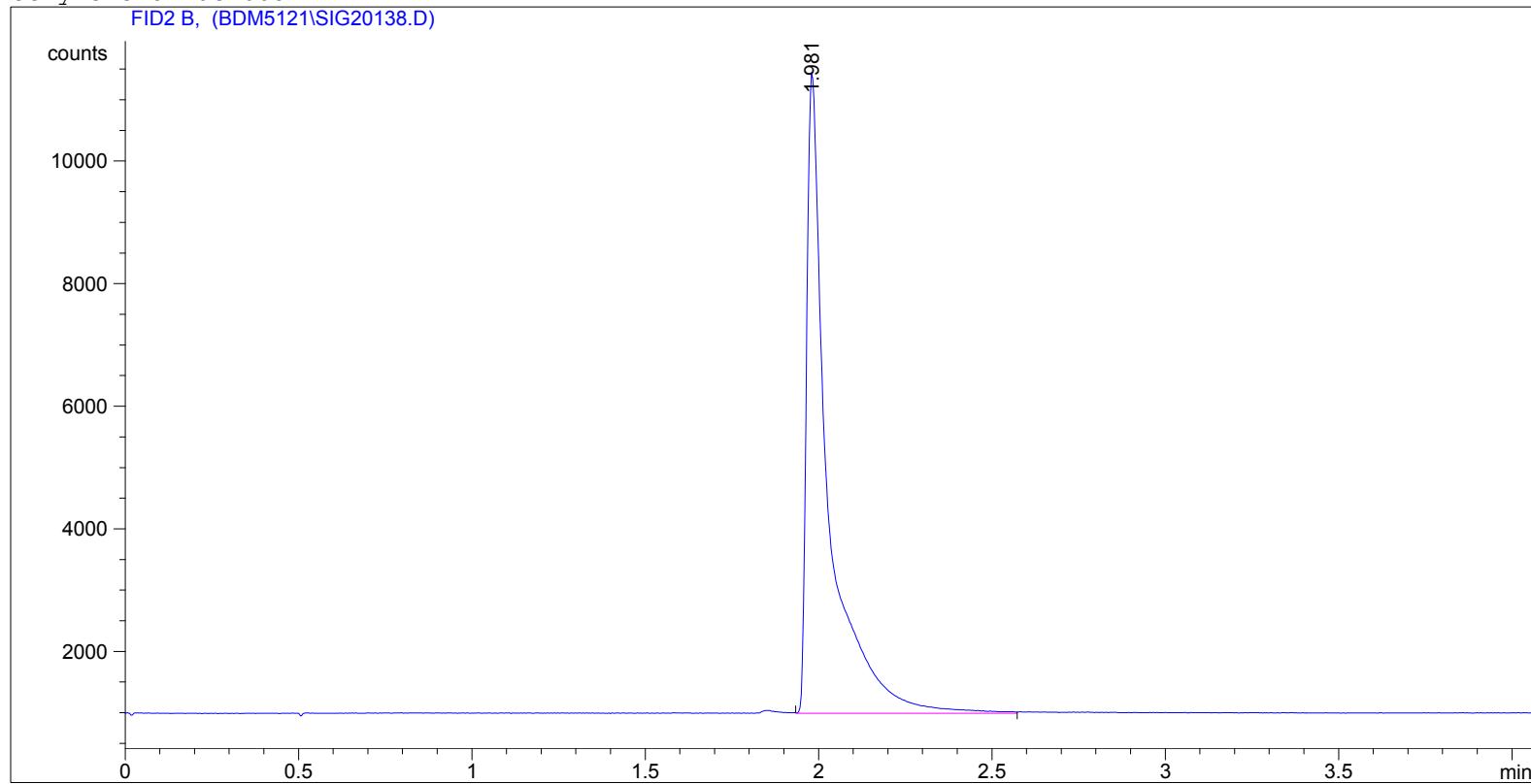
Totals : 4.82755e4 1.12457e4

Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet Run 2, Inj 5, Oven temp 45, Aux 100, 10 uL loo  
p

```
=====
Injection Date : 7/31/2015 10:25:14 AM
Sample Name : IN Run 2, Inj 5
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	1.981	VV	0.0604	4.51763e4	1.04628e4	1.000e2

Totals : 4.51763e4 1.04628e4

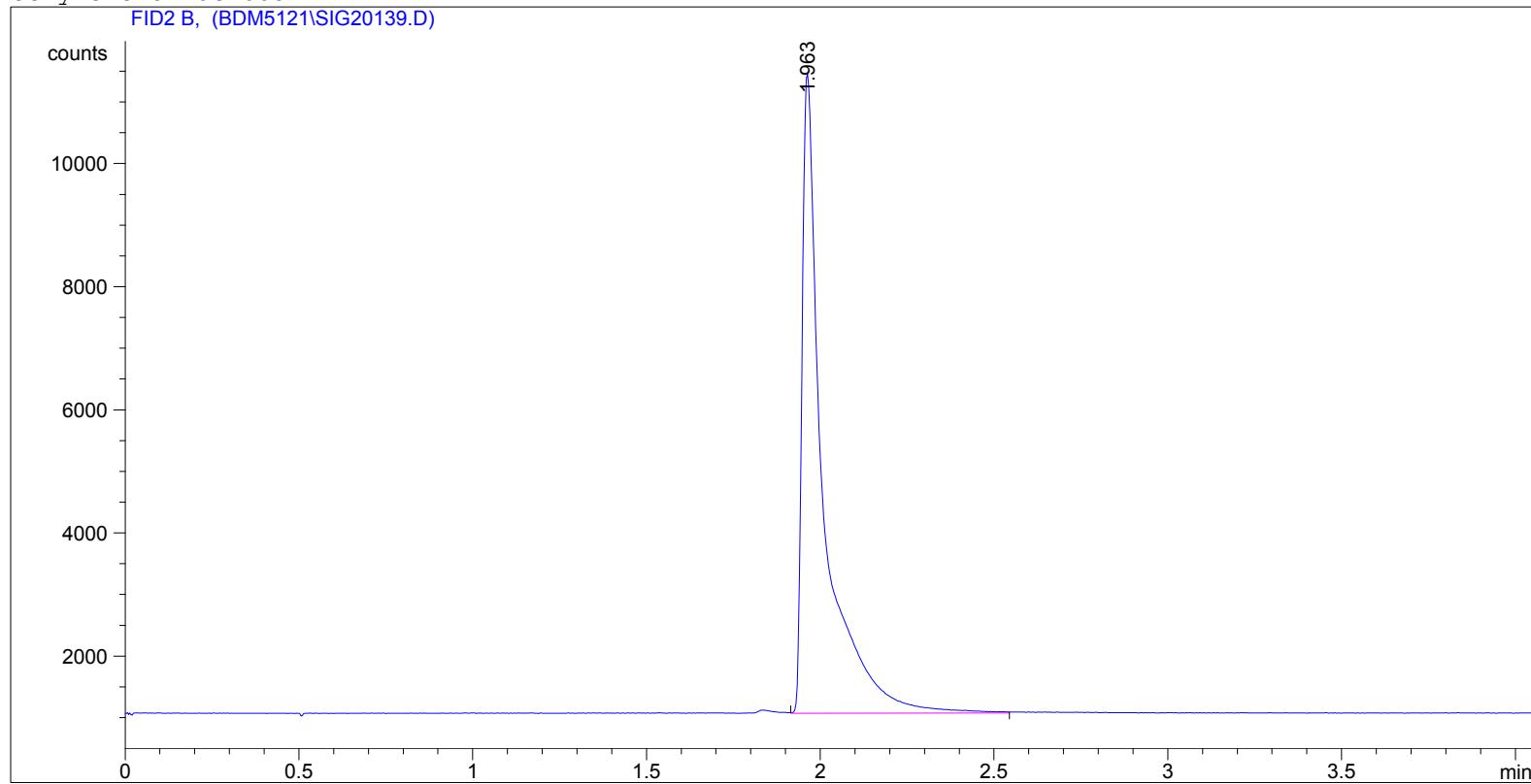
Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet Run 3, Inj 1, Oven temp 45, Aux 100, 10 uL loo  
p

=====

Injection Date : 7/31/2015 11:26:37 AM  
Sample Name : IN Run 3, Inj 1 Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	1.963	VV	0.0595	4.40841e4	1.03944e4	1.000e2

Totals : 4.40841e4 1.03944e4

Results obtained with enhanced integrator!

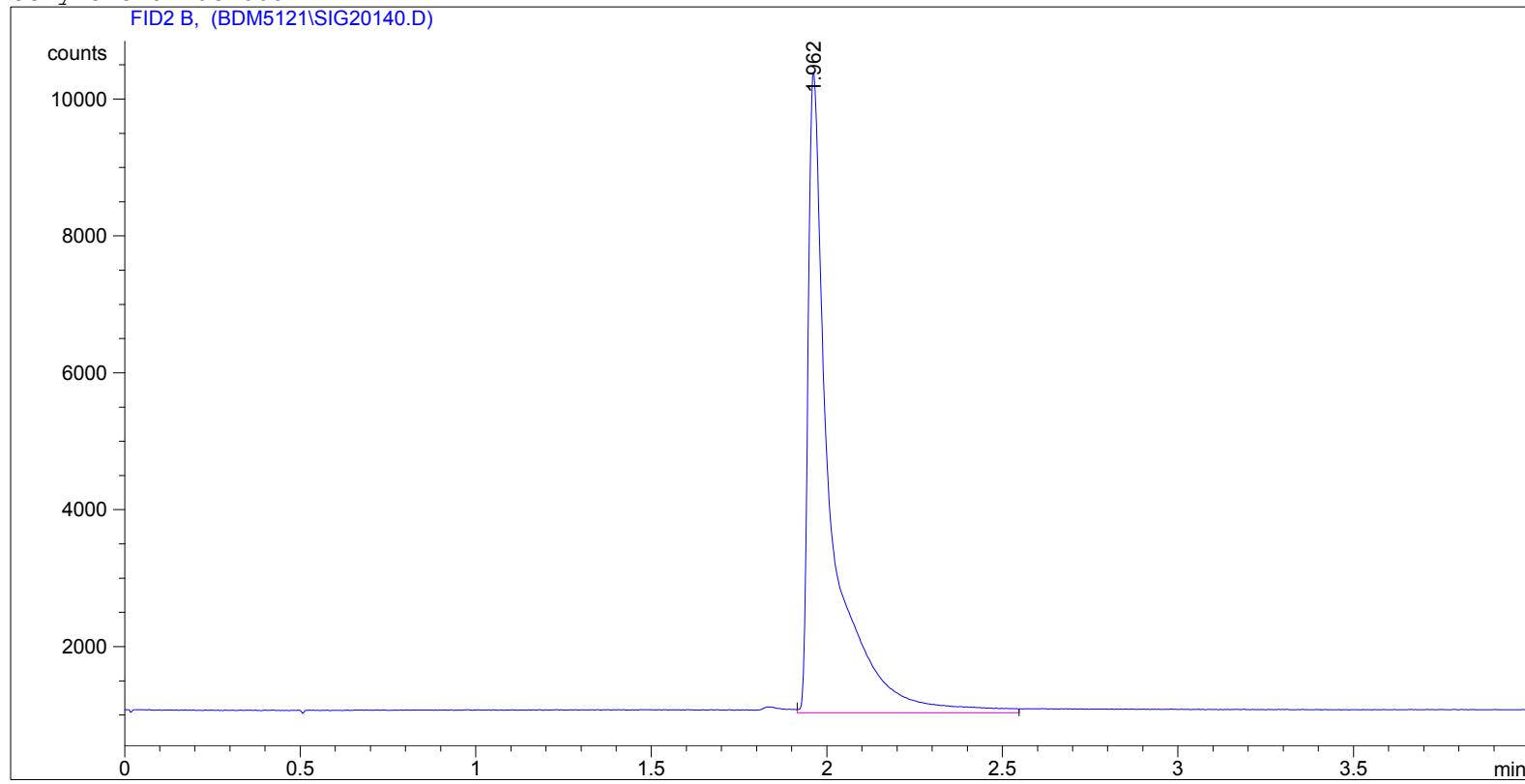
=====

\*\*\* End of Report \*\*\*

EO Inlet Run 3, Inj 2, Oven temp 45, Aux 100, 10 uL loo  
p

=====

Injection Date : 7/31/2015 11:35:12 AM  
Sample Name : IN Run 3, Inj 2 Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	1.962	VV	0.0615	4.13234e4	9368.25000	1.000e2

Totals : 4.13234e4 9368.25000

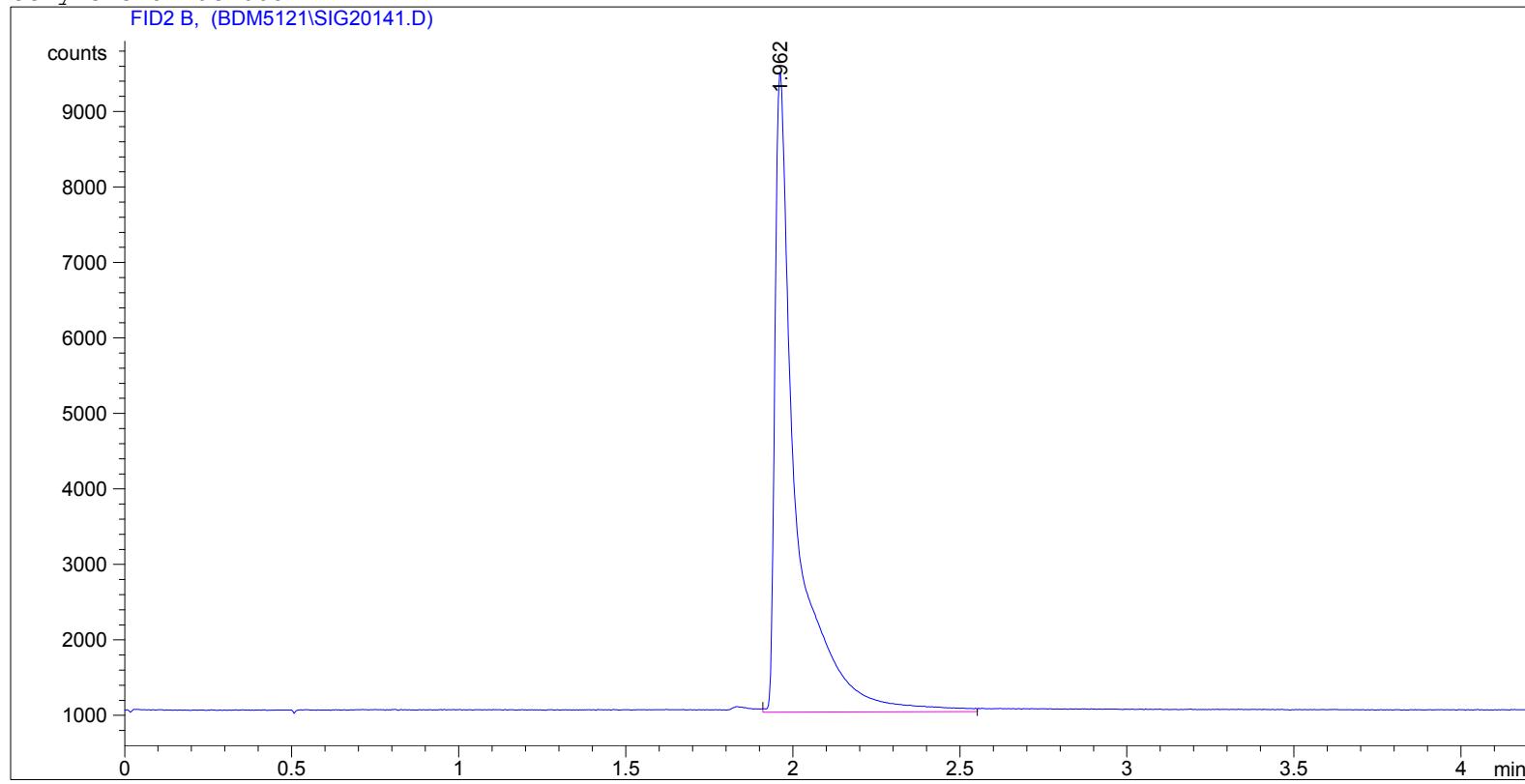
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Inlet Run 3, Inj 3, Oven temp 45, Aux 100, 10 uL loo  
p

```
=====
Injection Date : 7/31/2015 11:40:05 AM
Sample Name : IN Run 3, Inj 3
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	1.962	VV	0.0612	3.72122e4	8484.28027	1.000e2

Totals : 3.72122e4 8484.28027

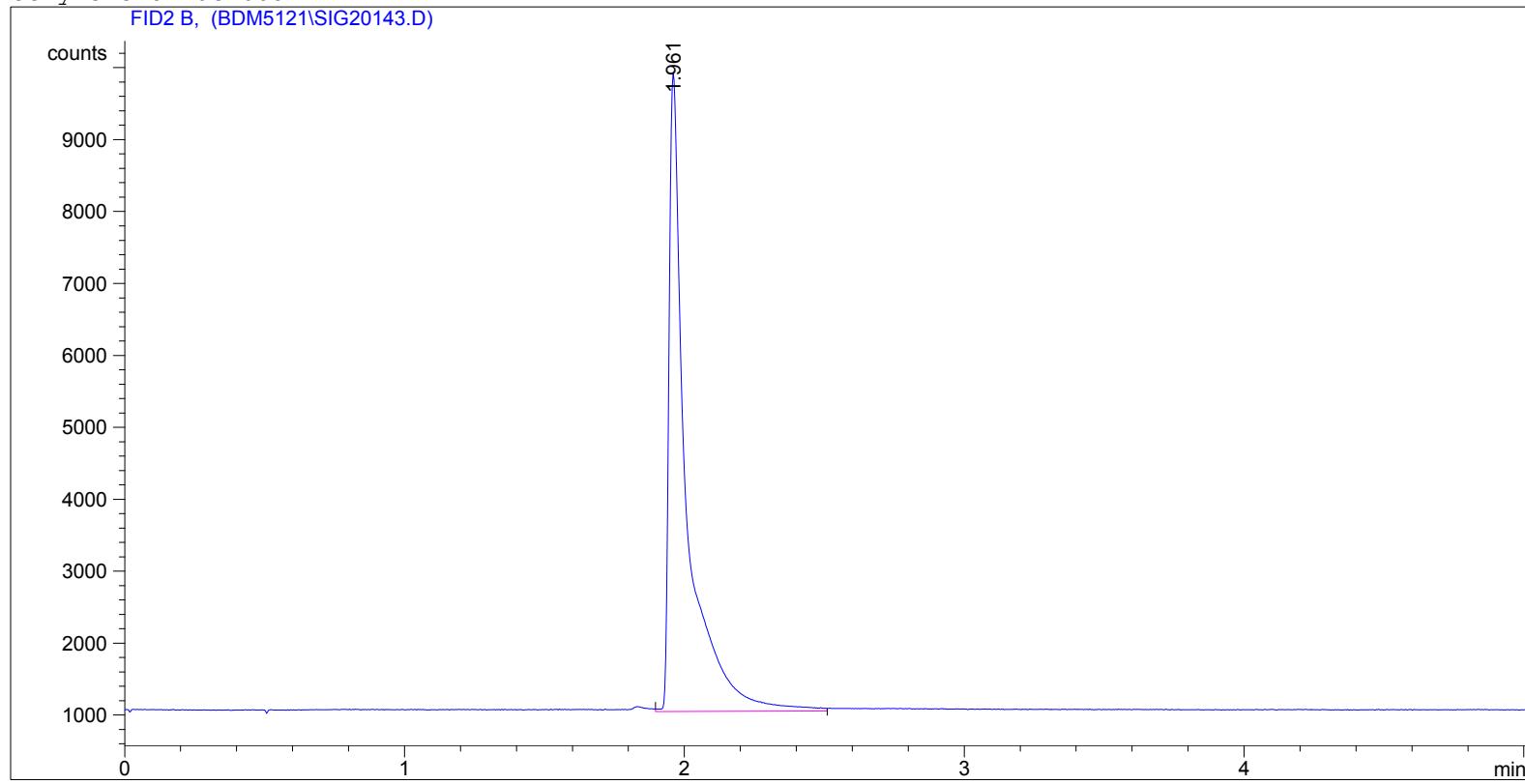
Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet Run 3, Inj 4, Oven temp 45, Aux 100, 10 uL loo  
p

=====

Injection Date : 7/31/2015 11:52:56 AM  
Sample Name : IN Run 3, Inj 4 Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	1.961	VV	0.0596	3.85656e4	8884.08203	1.000e2

Totals : 3.85656e4 8884.08203

Results obtained with enhanced integrator!

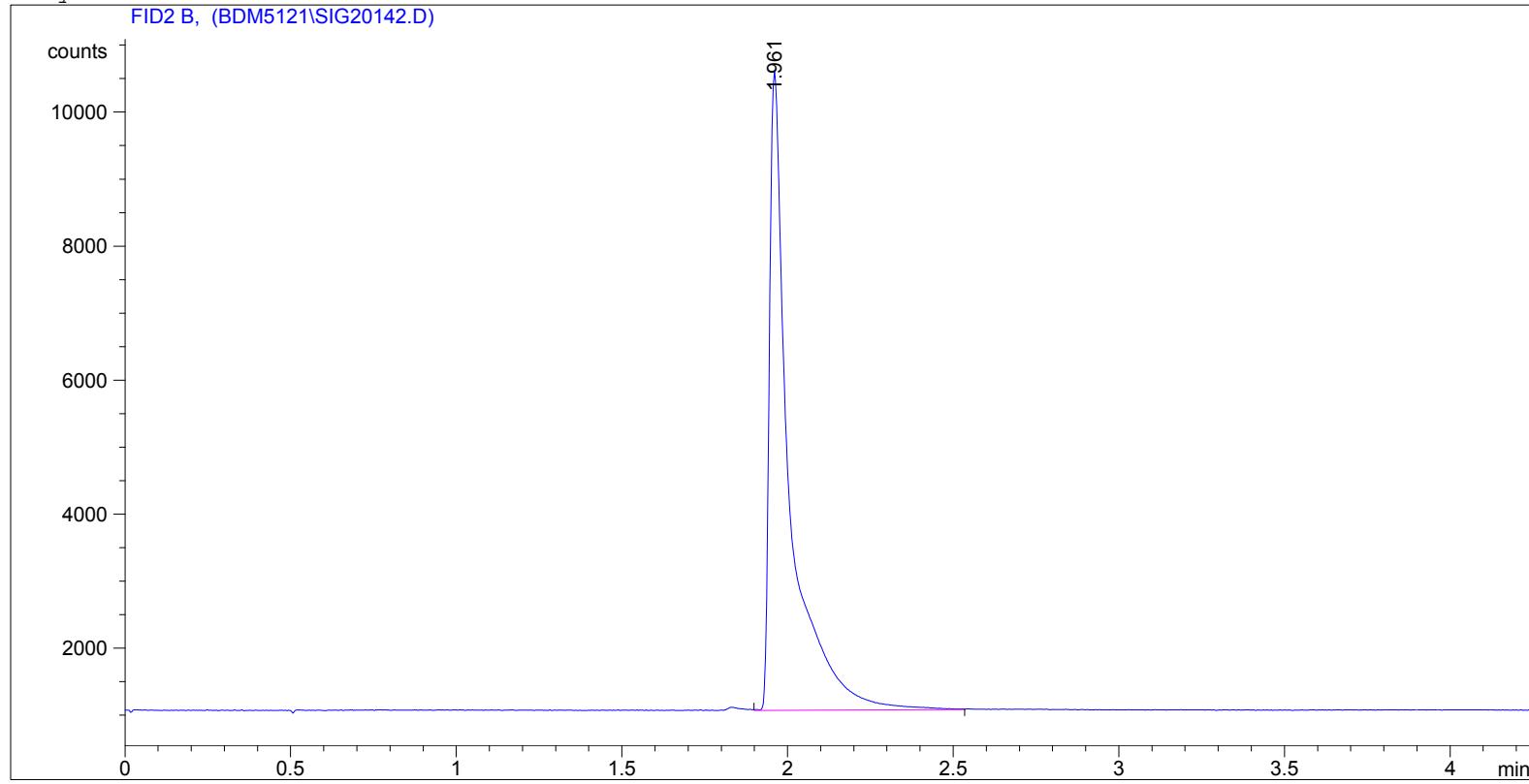
=====

\*\*\* End of Report \*\*\*

EO Inlet Run 3, Inj 4, Oven temp 45, Aux 100, 10 uL loo  
p

=====

Injection Date : 7/31/2015 11:47:57 AM  
Sample Name : IN Run 3, Inj 4 Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	1.961	VV	0.0594	4.04295e4	9542.21875	1.000e2

Totals : 4.04295e4 9542.21875

Results obtained with enhanced integrator!

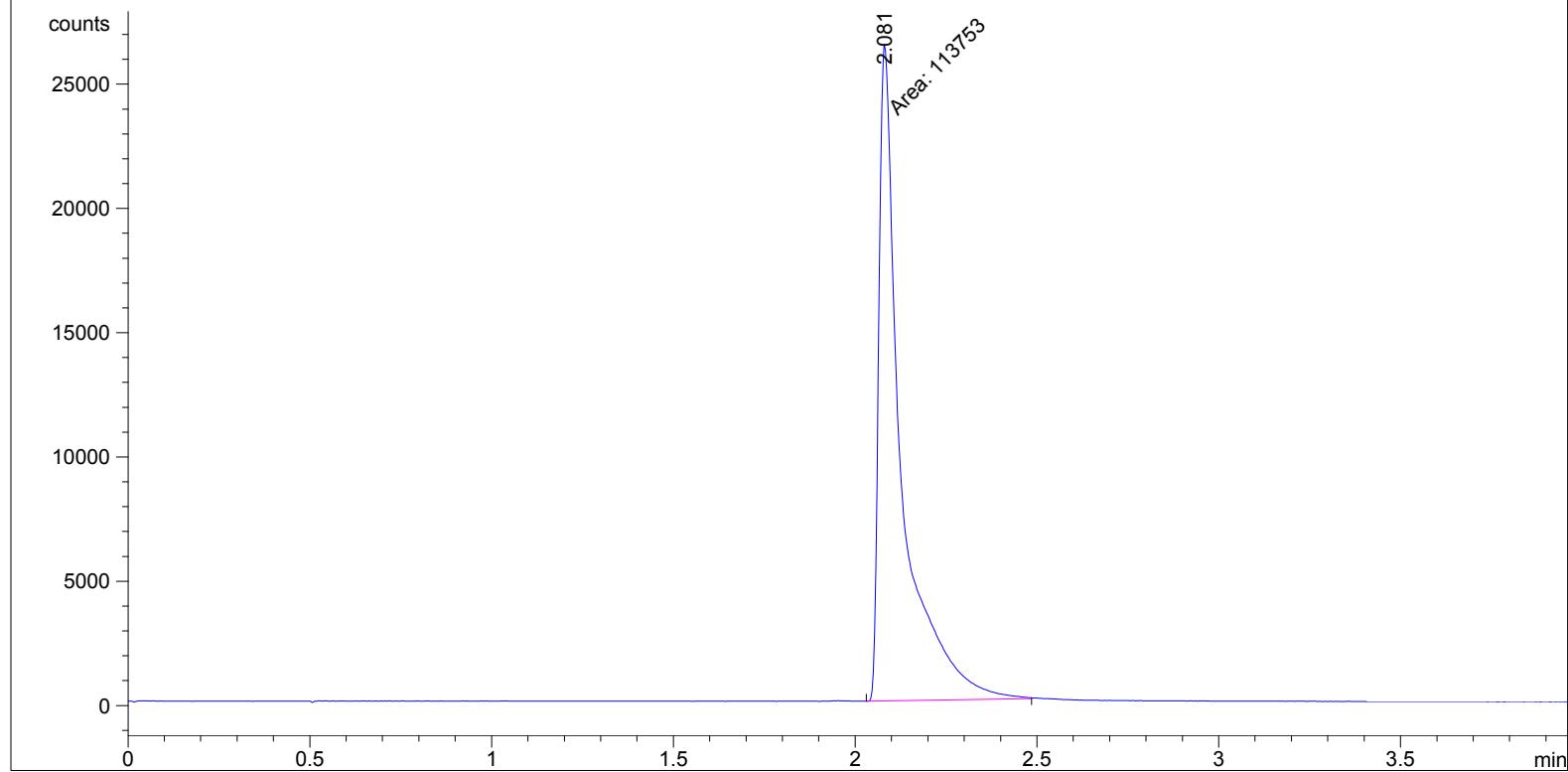
=====

\*\*\* End of Report \*\*\*

EO Inlet Pre Line Loss 5210ppm, Oven temp 45, Aux 100,  
10 uL loop

```
=====
Injection Date : 7/30/2015 11:33:30 AM
Sample Name : IN Pre Line Loss
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```

FID2 B, (BDM5121\SIG20118.D)



=====
Area Percent Report
=====

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.081	MM	0.0716	1.13753e5	2.64915e4	1.000e2

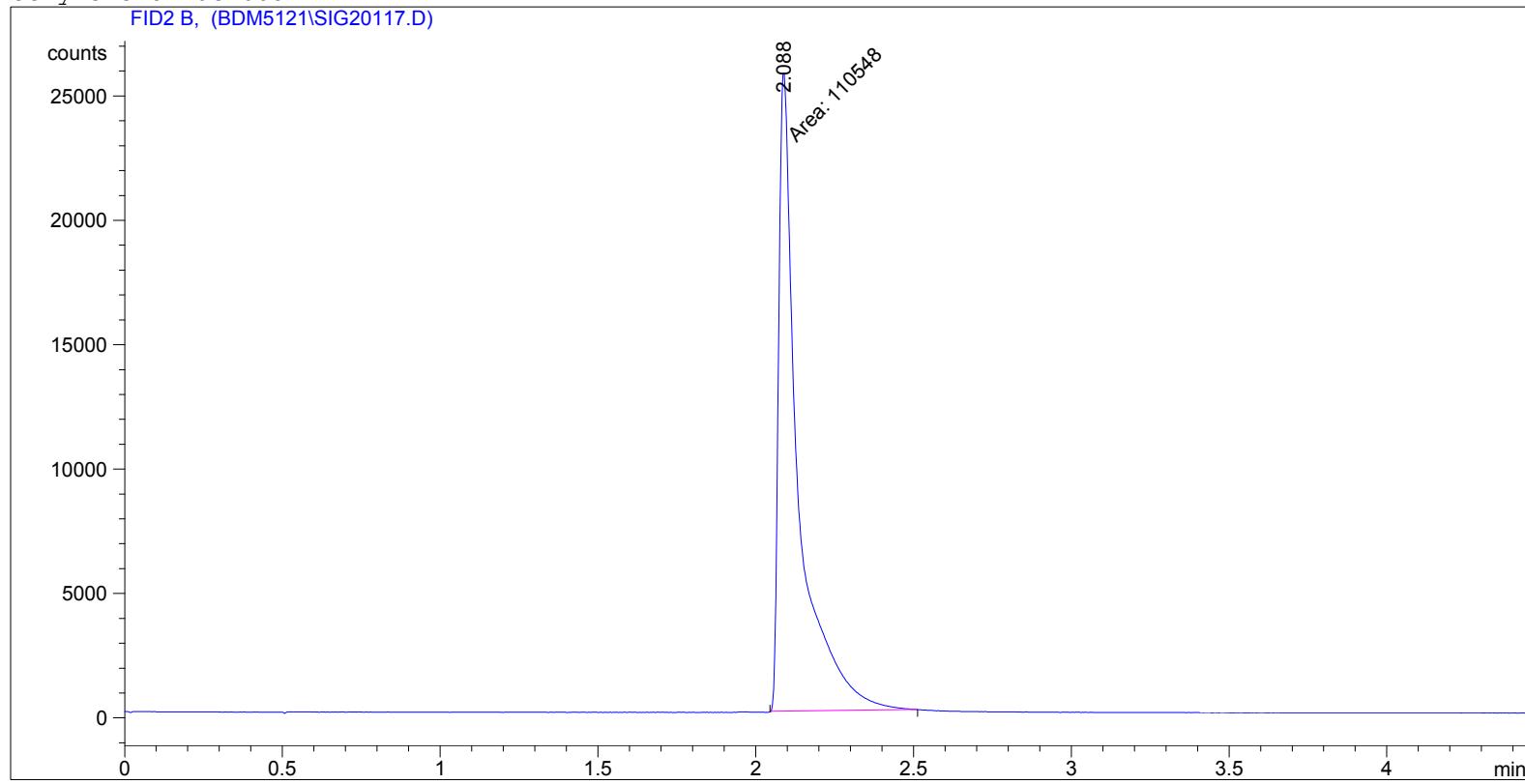
Totals : 1.13753e5 2.64915e4

Results obtained with enhanced integrator!

=====
\*\*\* End of Report \*\*\*
=====

EO Inlet Pre Line Loss 5210ppm, Oven temp 45, Aux 100,  
10 uL loop

```
=====
Injection Date : 7/30/2015 11:26:56 AM
Sample Name : IN Pre Line Loss
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.088	MM	0.0715	1.10548e5	2.57538e4	1.000e2

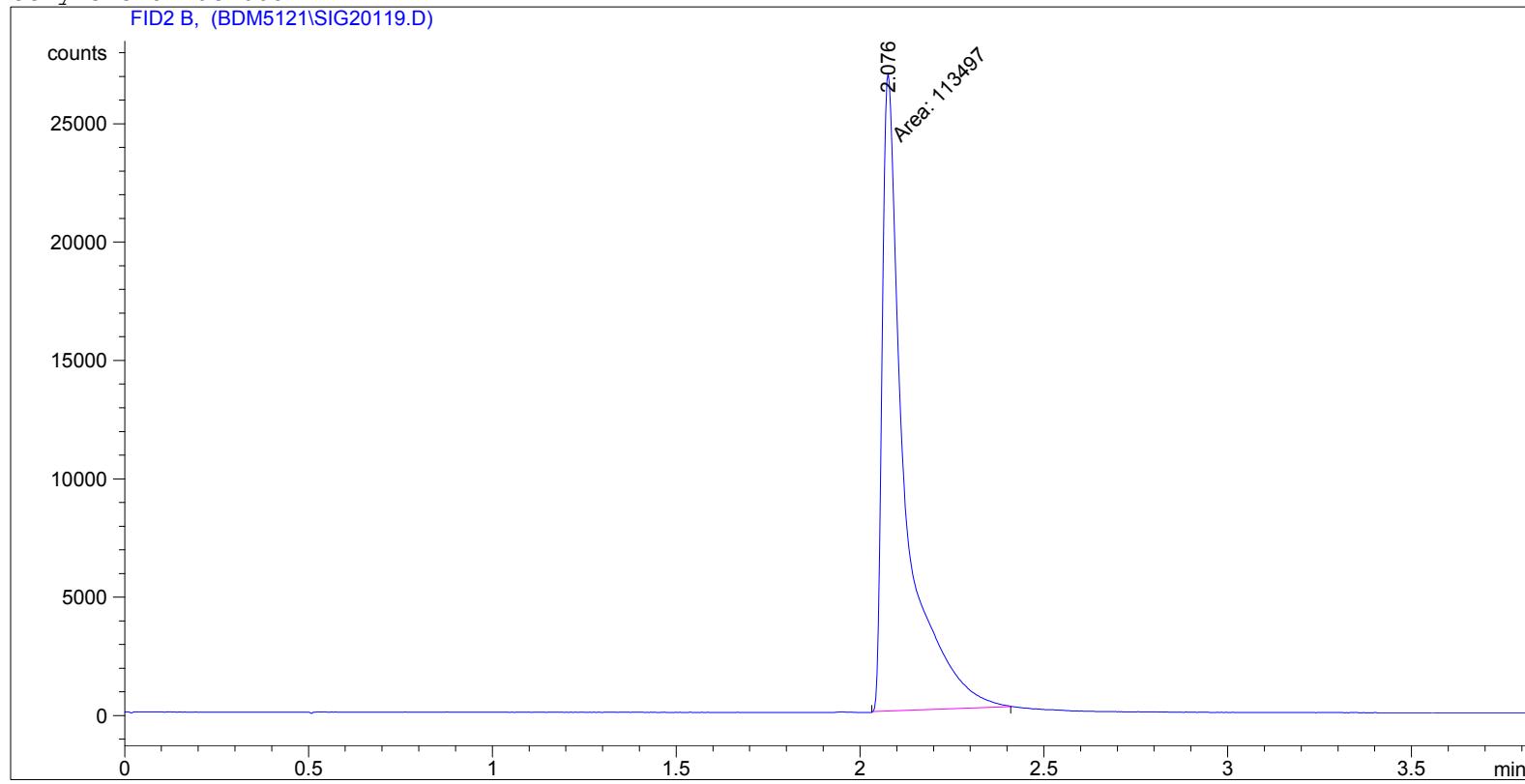
Totals : 1.10548e5 2.57538e4

Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet Pre Line Loss 5210ppm, Oven temp 45, Aux 100,  
10 uL loop

```
=====
Injection Date : 7/30/2015 11:38:03 AM
Sample Name : IN Pre Line Loss
Location : Vial 2
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.076	MM	0.0701	1.13497e5	2.69877e4	1.000e2

Totals : 1.13497e5 2.69877e4

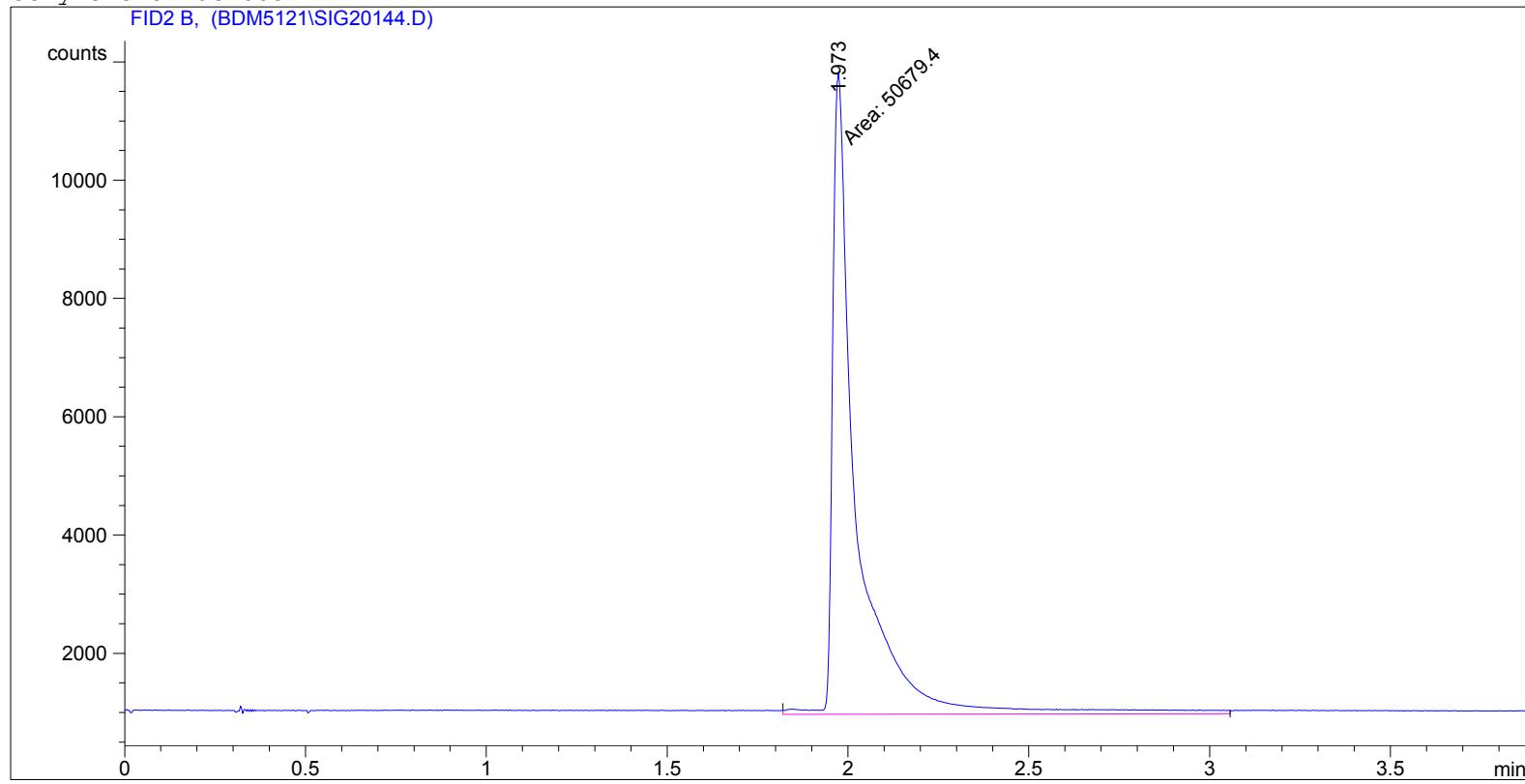
Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet Run 3, Inj 4, Oven temp 45, Aux 100, 10 uL loo  
p

=====

Injection Date : 7/31/2015 12:19:48 PM  
Sample Name : IN Run 3, Inj 4 Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	1.973	MM	0.0778	5.06794e4	1.08581e4	1.000e2

Totals : 5.06794e4 1.08581e4

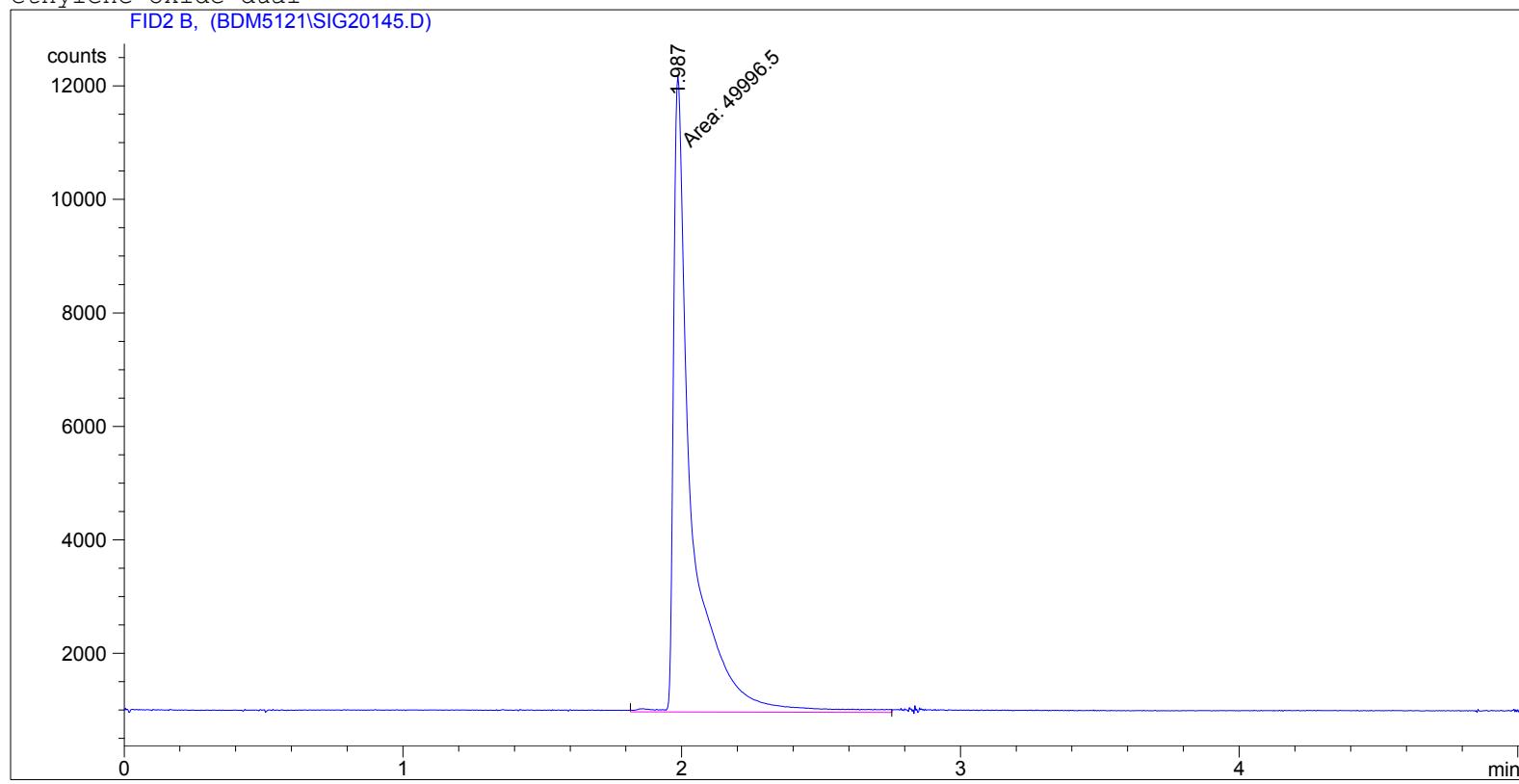
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Inlet Post Calv 2603ppm, Oven temp 45, Aux 100, 10 u  
L loop

```
=====
Injection Date : 7/31/2015 12:28:22 PM
Sample Name : IN Post Cal
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	1.987	MM	0.0742	4.99965e4	1.12300e4	1.000e2

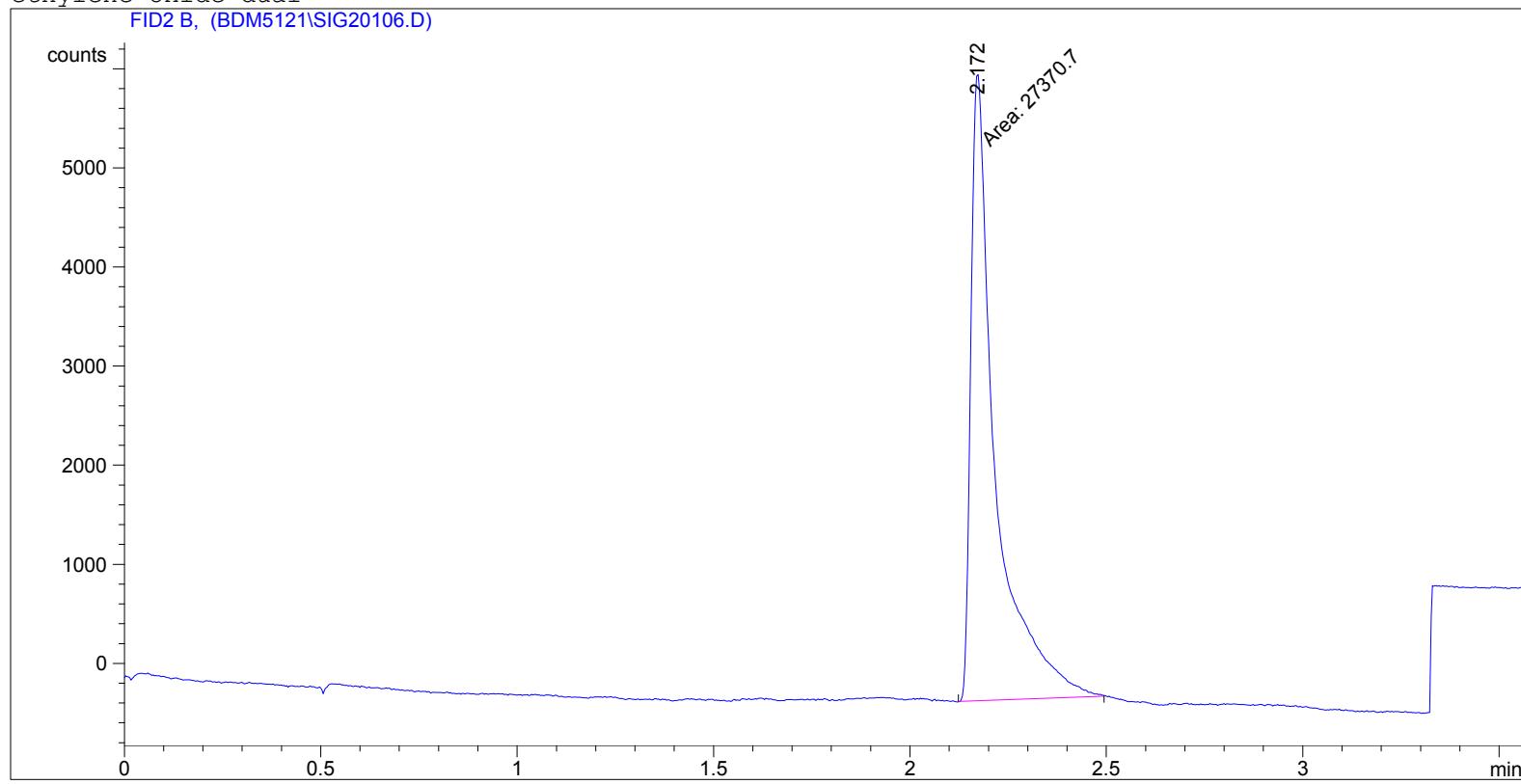
Totals : 4.99965e4 1.12300e4

Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet 1302ppm, Oven temp 45, Aux 100, 10 uL loop

```
=====
Injection Date : 7/30/2015 9:30:53 AM
Sample Name : IN 1302ppm
Location : Vial 2
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width MM	Area counts*s	Height [counts]	Area %
1	2.172	MM	0.0720	2.73707e4	6336.83398	1.000e2

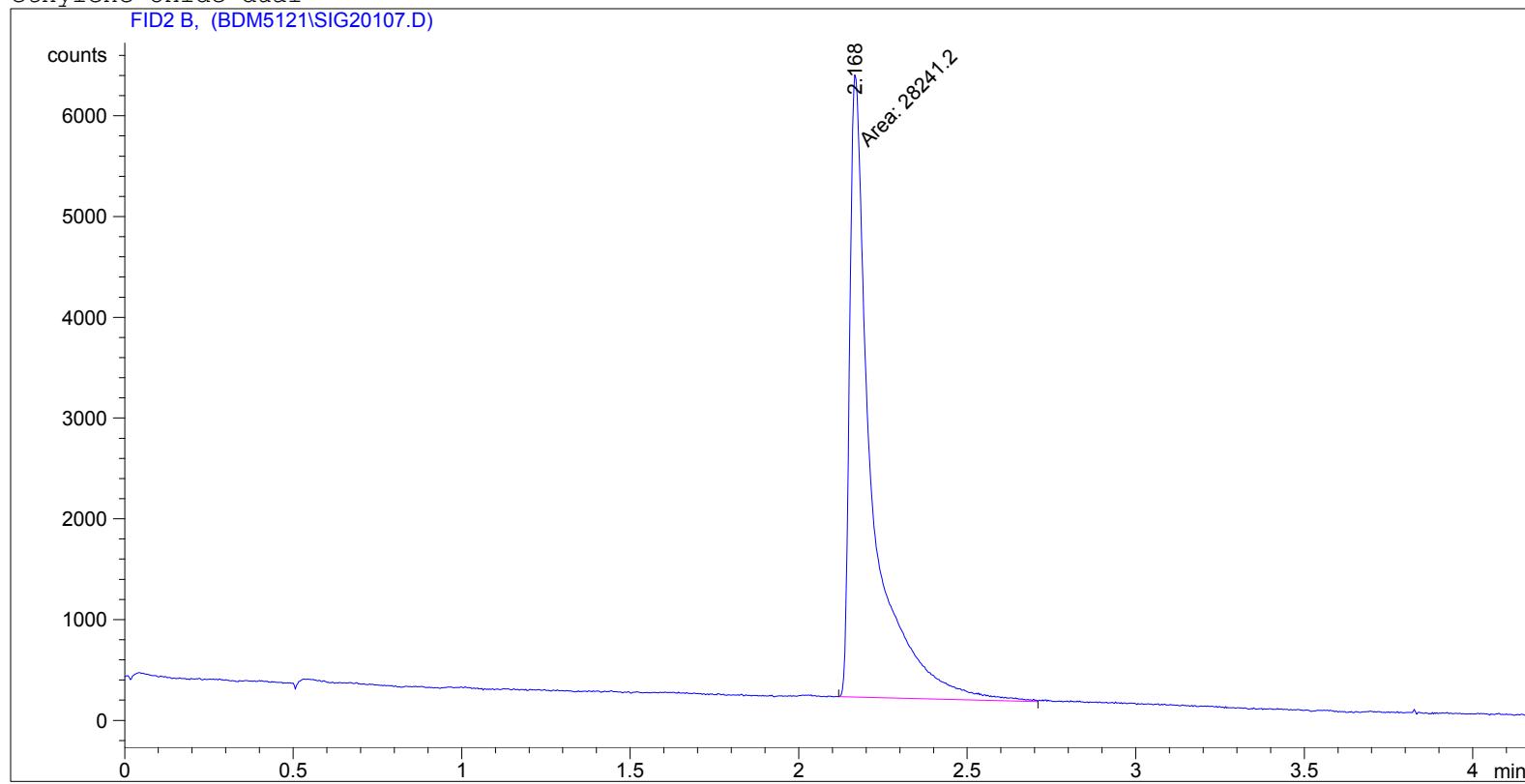
Totals : 2.73707e4 6336.83398

Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet 1302ppm, Oven temp 45, Aux 100, 10 uL loop

```
=====
Injection Date : 7/30/2015 9:38:19 AM
Sample Name : IN 1302ppm
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.168	MM	0.0760	2.82412e4	6189.82031	1.000e2

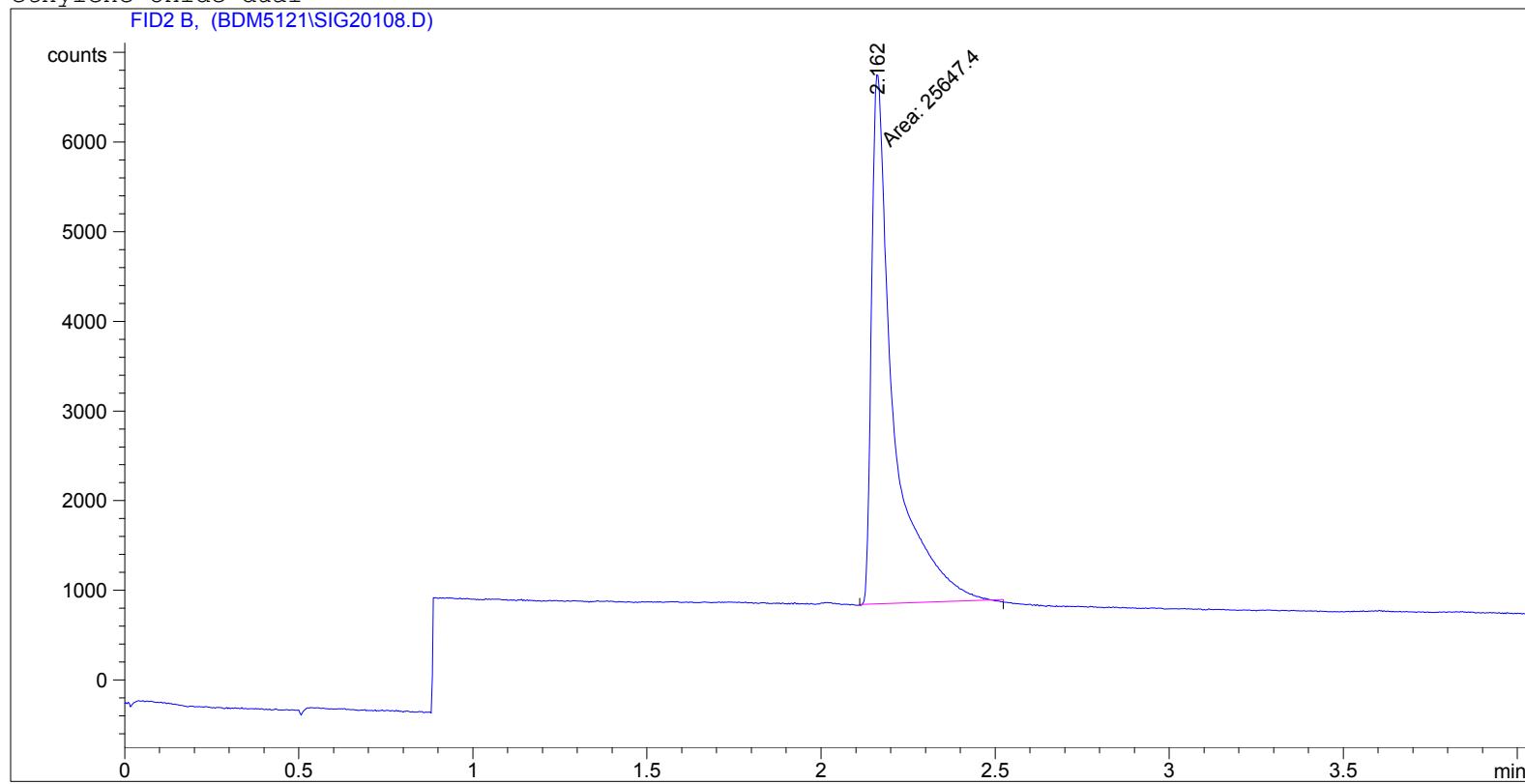
Totals : 2.82412e4 6189.82031

Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet 1302ppm, Oven temp 45, Aux 100, 10 uL loop

```
=====
Injection Date : 7/30/2015 9:46:35 AM
Sample Name : IN 1302ppm
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width MM	Area counts*s	Height [counts]	Area %
1	2.162	MM	0.0721	2.56474e4	5929.51270	1.000e2

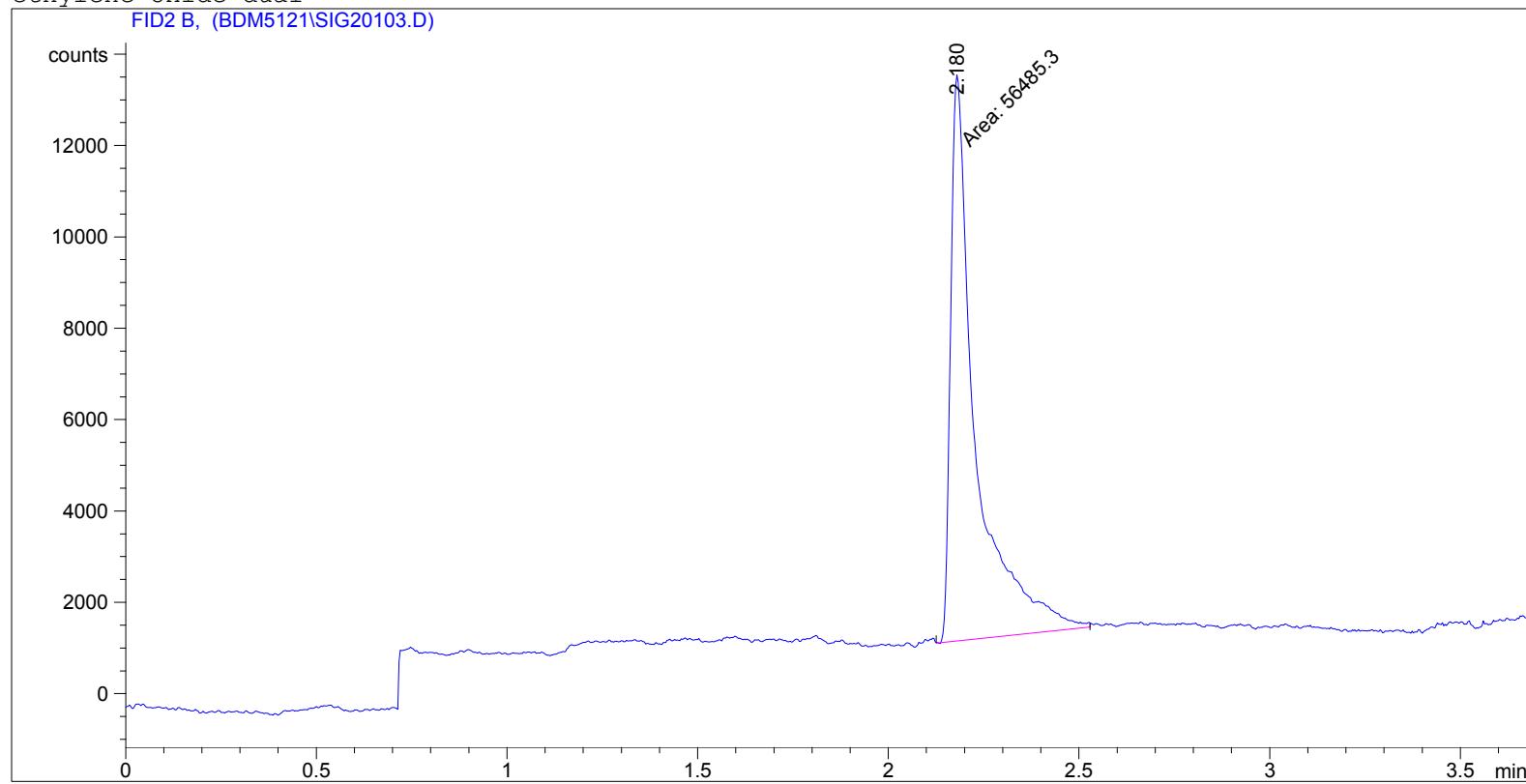
Totals : 2.56474e4 5929.51270

Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet 2605ppm, Oven temp 45, Aux 100, 10 uL loop

```
=====
Injection Date : 7/30/2015 8:58:48 AM
Sample Name : IN 2605ppm
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.180	MM	0.0759	5.64853e4	1.24092e4	1.000e2

Totals : 5.64853e4 1.24092e4

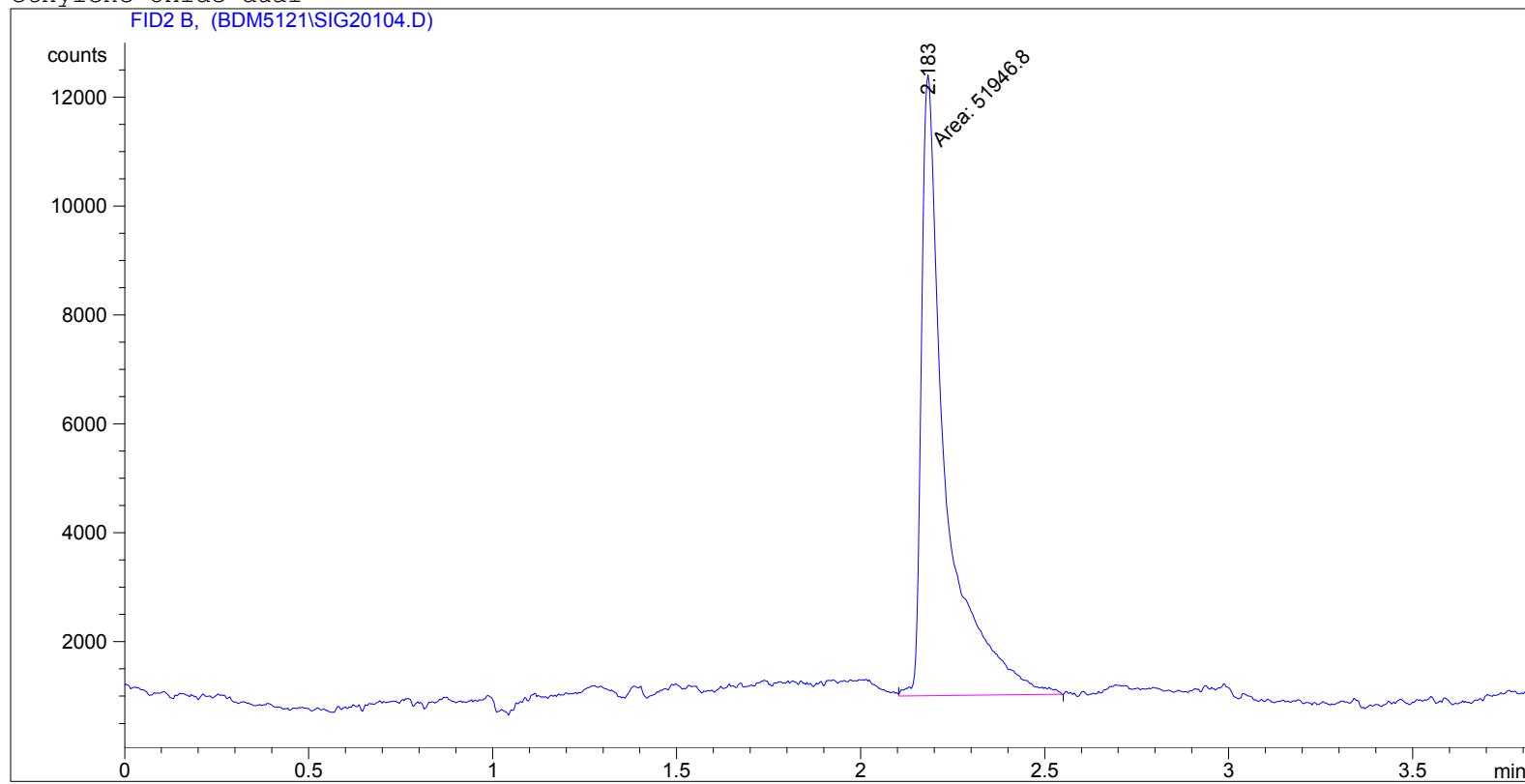
Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet 2605ppm, Oven temp 45, Aux 100, 10 uL loop

=====

Injection Date : 7/30/2015 9:07:47 AM  
Sample Name : IN 2605ppm Location : Vial 2  
Acq. Operator : JH  
Acq. Instrument : Instrument 1 Inj Volume : External  
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M  
Last changed : 7/2/2015 1:34:02 PM by JCH  
ethylene oxide dual



=====

Area Percent Report

=====

Sorted By : Signal  
Multiplier : 1.0000  
Dilution : 1.0000  
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width MM	Area counts*s	Height [counts]	Area %
1	2.183	MM	0.0759	5.19468e4	1.14139e4	1.000e2

Totals : 5.19468e4 1.14139e4

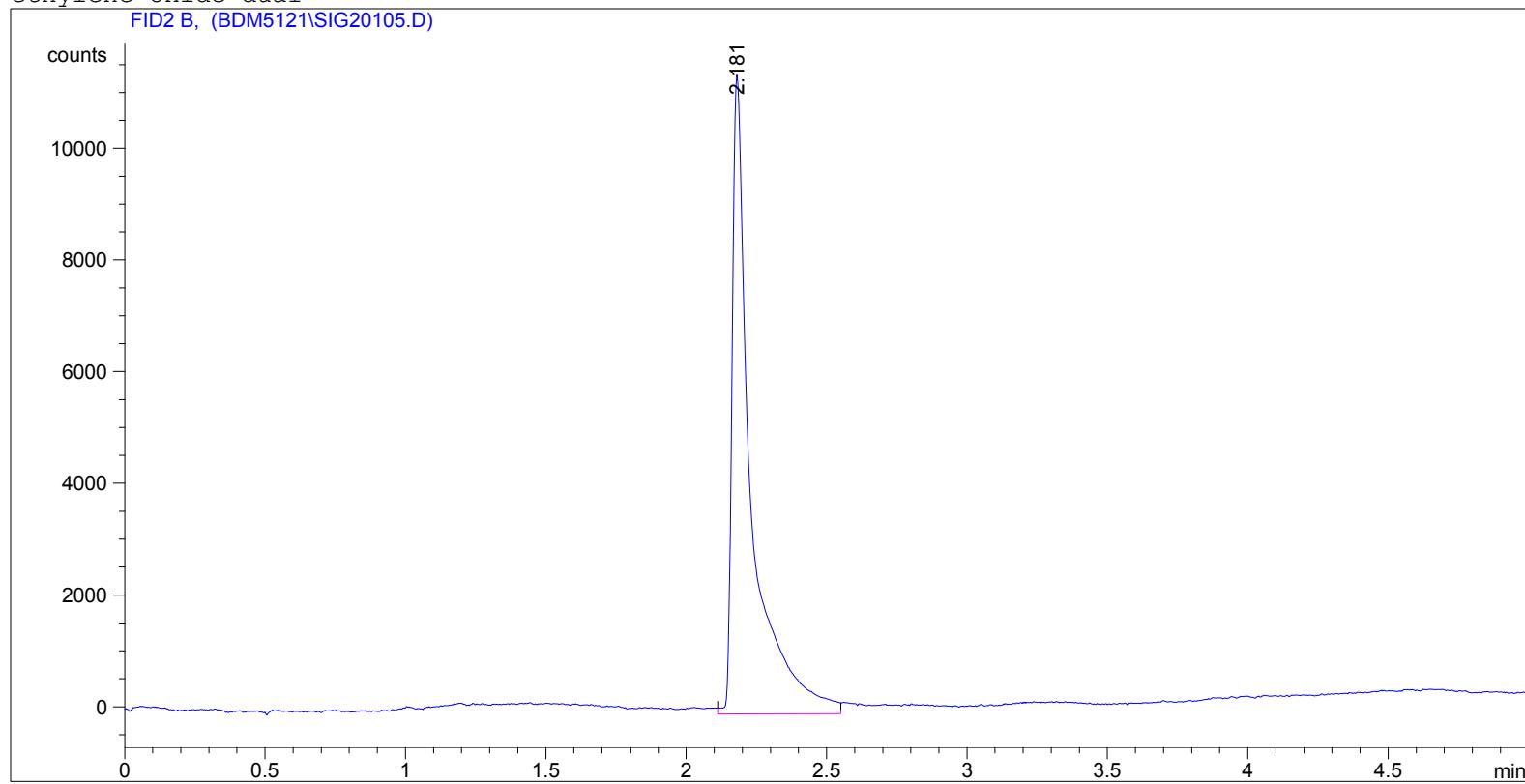
Results obtained with enhanced integrator!

=====

\*\*\* End of Report \*\*\*

EO Inlet 2605ppm, Oven temp 45, Aux 100, 10 uL loop

```
=====
Injection Date : 7/30/2015 9:16:41 AM
Sample Name : IN 2605ppm
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.181	VV	0.0662	5.41376e4	1.14475e4	1.000e2

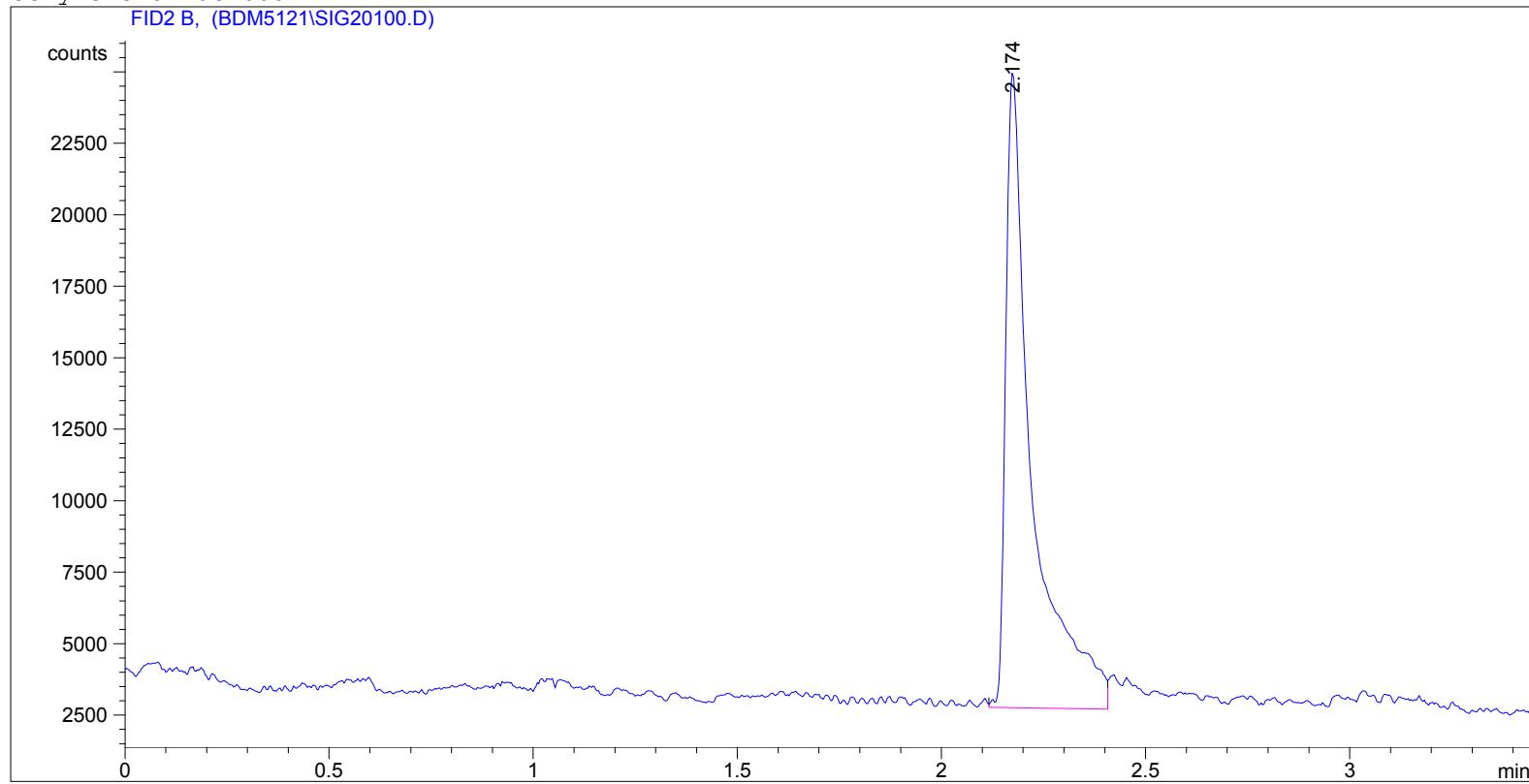
Totals : 5.41376e4 1.14475e4

Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet 5210ppm, Oven temp 45, Aux 100, 10 uL loop

```
=====
Injection Date : 7/30/2015 8:34:33 AM
Sample Name : IN 5210ppm
Location : Vial 2
Acq. Operator : JH
Acq. Instrument : Instrument 1
Inj Volume : External
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.174	VV	0.0631	9.93363e4	2.22318e4	1.000e2

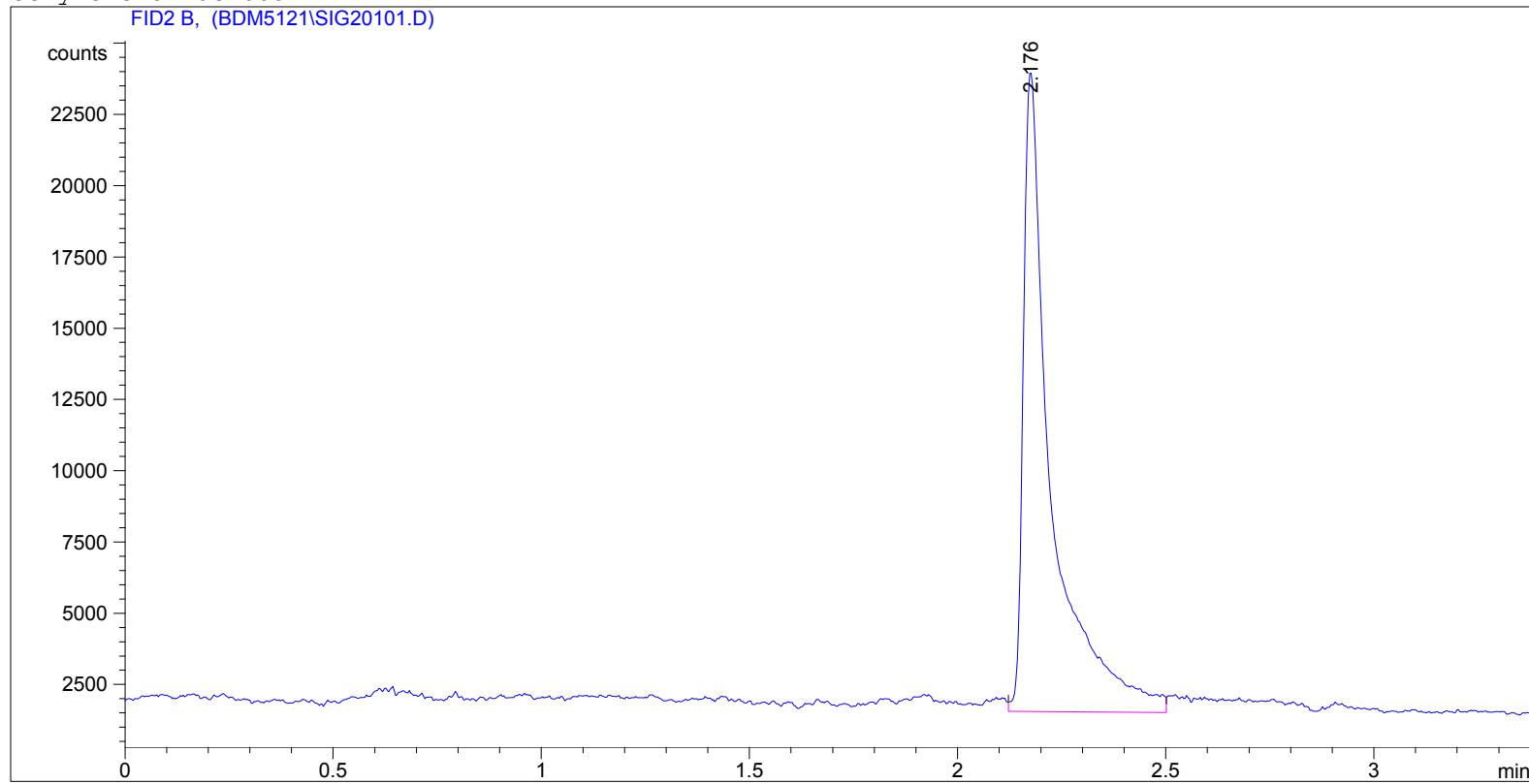
Totals : 9.93363e4 2.22318e4

Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet 5210ppm, Oven temp 45, Aux 100, 10 uL loop

```
=====
Injection Date : 7/30/2015 8:42:00 AM
Sample Name : IN 5210ppm
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.176	VV	0.0643	1.04394e5	2.24250e4	1.000e2

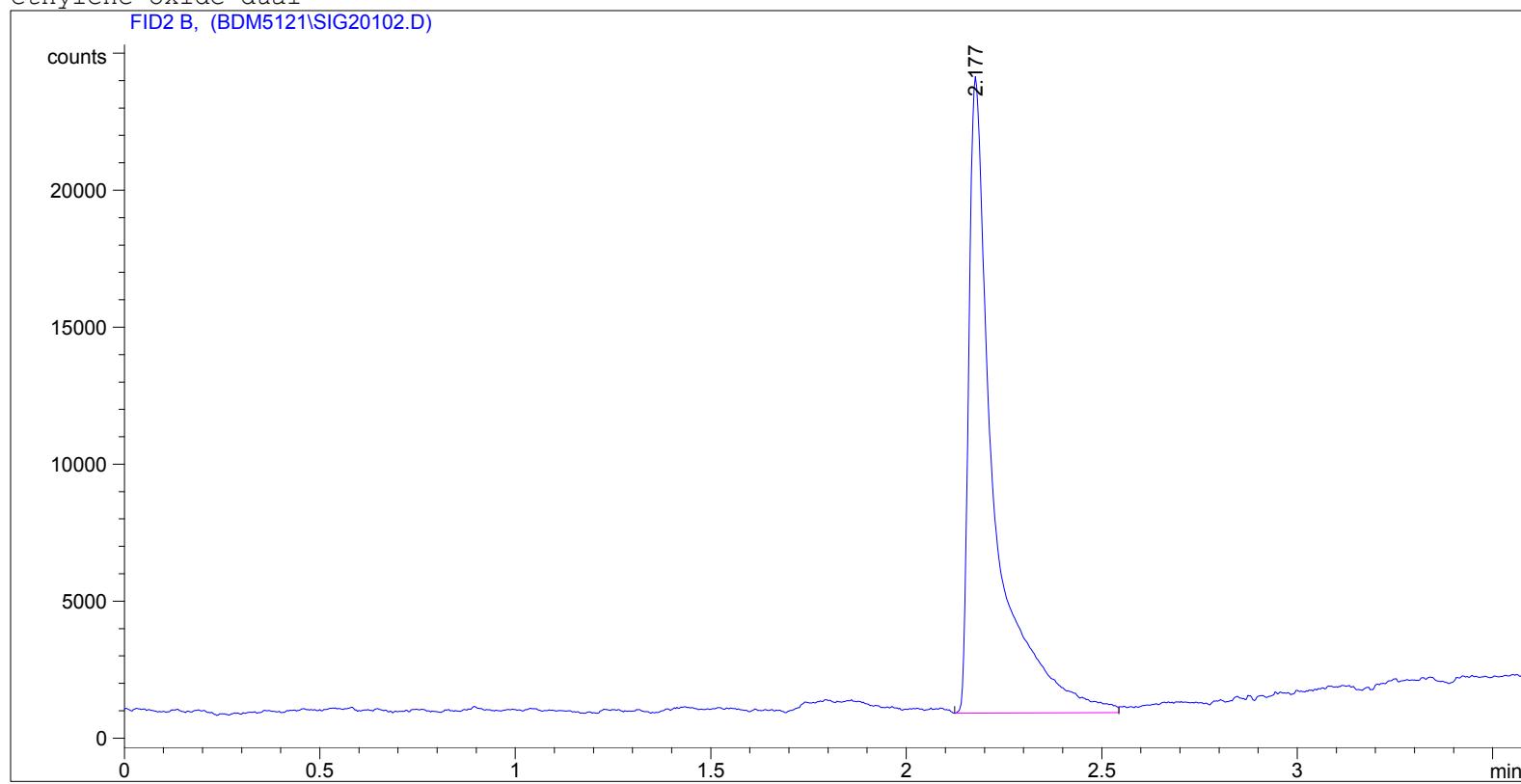
Totals : 1.04394e5 2.24250e4

Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```

EO Inlet 5210ppm, Oven temp 45, Aux 100, 10 uL loop

```
=====
Injection Date : 7/30/2015 8:49:10 AM
Sample Name : IN 5210ppm
Acq. Operator : JH
Acq. Instrument : Instrument 1
Method : C:\HPCHEM\1\METHODS\ETHYDUAL.M
Last changed : 7/2/2015 1:34:02 PM by JCH
ethylene oxide dual
```



```
=====
Area Percent Report
=====
```

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID2 B,

Peak #	RetTime [min]	Type	Width [min]	Area counts*s	Height [counts]	Area %
1	2.177	VV	0.0630	1.03677e5	2.32395e4	1.000e2

Totals : 1.03677e5 2.32395e4

Results obtained with enhanced integrator!

```
=====
*** End of Report ***
=====
```



## Appendix Three: Calibration Information



## Wind Tunnel Pitot Calibration

S-type Pitot ID: **P-867** Date: **6-May-14**  
 Standard Pitot ID: **001** Personnel: **DH**  
 Cp(std): **0.99** Cp(actual): **0.838**  
 Part Number: **PPS12-Y-007.5** P<sub>bar</sub>(in Hg): **29.47**  
 Test Velocity (fps): **50** T(°F): **78**

A-SIDE	<b>ΔP<sub>std</sub></b> (in. H <sub>2</sub> O)	<b>ΔP<sub>s</sub></b> (in. H <sub>2</sub> O)	<b>Cp(s)</b>	<b>Deviation*</b>
	<b>0.545</b>	<b>0.751</b>	<b>0.843</b>	0.001
	<b>0.546</b>	<b>0.756</b>	<b>0.842</b>	-0.001
	<b>0.548</b>	<b>0.755</b>	<b>0.844</b>	0.001
	<b>0.548</b>	<b>0.760</b>	<b>0.840</b>	-0.002
	<b>AVERAGE</b>		<b>0.842</b>	0.001
			Std deviation	0.002

B-SIDE	<b>ΔP<sub>std</sub></b> (in. H <sub>2</sub> O)	<b>ΔP<sub>s</sub></b> (in. H <sub>2</sub> O)	<b>Cp(s)</b>	<b>Deviation*</b>
	<b>0.548</b>	<b>0.766</b>	<b>0.837</b>	0.003
	<b>0.548</b>	<b>0.774</b>	<b>0.832</b>	-0.002
	<b>0.546</b>	<b>0.772</b>	<b>0.833</b>	-0.001
	<b>0.547</b>	<b>0.771</b>	<b>0.834</b>	0.000
	<b>AVERAGE</b>		<b>0.834</b>	0.002
			Std deviation	0.002

$$Cp(s) = Cp(std) \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$Cp(A) - Cp(B) = [ \quad 0.008 \quad ] \{ \text{must be } < 0.010 \}$$

$$* \text{Deviation} = \{Cp(s) - AVG\ Cp(s)\} \{ \text{must be } < 0.010 \}$$

Standard deviation of the deviations must be less than 0.02 for both sides.

**Pitot tube S/N P-867 was calibrated in accordance with the CFR 40, Part 60  
Appendix A, Method 2, Section 10.**

  
Signature

5/6/14  
Date



### DRY GAS METER AND PYROMETER PRE-CALIBRATION DATA

Gas Meter ID.....	M5-19
Date.....	7/2/2015
Barometric Pressure (MBAR).....	840

Technician.....	DLM
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#### Reference Meter Calibration Data

	Run #1	Run #2	Run #3	Average
Yref	0.999	0.999	0.999	<b>0.999</b>
Yd	0.990	1.013	1.022	<b>1.008</b>
DH@	1.57	1.55	1.56	<b>1.56</b>
Pre Yd.....				<b>1.008</b>

Reference Meter ID.....	<b>2</b>
Reference Meter S/N.....	<b>6844262</b>
Reference Meter Yd.....	<b>0.999</b>
Calibration Date.....	<b>1/13/2015</b>
APT Recert Date.....	<b>1/13/2016</b>

#### Dry Gas Meter Calibration Data

Run #1	Delta H @ ("H <sub>2</sub> O)	Volume Meter (feet <sup>3</sup> )	Temp. In (°F)	Temp. Out (°F)	Volume Reference (feet <sup>3</sup> )	Temp. Ref. (°F)	Delta P ("H <sub>2</sub> O)	Vacuum ("Hg)	Time (min)
Start	0.5	69.824	75	74	826.549	71	0.41	15	1:30 PM
Stop	0.5	84.908	76	75	841.461	73	0.42	15	2:02 PM
Average	<b>0.5</b>	<b>15.084</b>	<b>76</b>	<b>75</b>	<b>14.912</b>	<b>72</b>	<b>0.42</b>	<b>15</b>	<b>32.0</b>

Run #2	Delta H @ ("H <sub>2</sub> O)	Volume Meter (feet <sup>3</sup> )	Temp. In (°F)	Temp. Out (°F)	Volume Reference (feet <sup>3</sup> )	Temp. Ref. (°F)	Delta P ("H <sub>2</sub> O)	Vacuum ("Hg)	Time (min)
Start	1.5	86.155	76	75	842.729	71	1.10	14	2:05 PM
Stop	1.5	106.163	77	76	863.019	73	1.1	14	2:30 PM
Average	<b>1.5</b>	<b>20.008</b>	<b>77</b>	<b>76</b>	<b>20.290</b>	<b>72</b>	<b>1.10</b>	<b>14</b>	<b>25.0</b>

Run #3	Delta H @ ("H <sub>2</sub> O)	Volume Meter (feet <sup>3</sup> )	Temp. In (°F)	Temp. Out (°F)	Volume Reference (feet <sup>3</sup> )	Temp. Ref. (°F)	Delta P ("H <sub>2</sub> O)	Vacuum ("Hg)	Time (min)
Start	3.0	107.731	77	76	864.632	72	2.00	11	2:32 PM
Stop	3.0	124.405	79	76	881.776	72	2	11	2:47 PM
Average	<b>3.0</b>	<b>16.674</b>	<b>78</b>	<b>76</b>	<b>17.144</b>	<b>72</b>	<b>2.00</b>	<b>11</b>	<b>15.0</b>

Pitot Leak Check
0.00 @ 3" H <sub>2</sub> O Positive.....
0.00 @ 3" H <sub>2</sub> O Negative.....

System Response Check
T/C Out (5).....
Filter In.....

Visual System Check
Manometer Oil Levels.....
Physical Inspection.....

#### Pyrometer Calibration Data

Calibration Temp. Reading (F)	Pyrometer Reading (F)	ABS (Relative Difference) % R
0	0	0.0
50	48	0.4
100	98	0.4
150	149	0.2
250	250	0.0
500	498	0.2
800	801	0.1
Max Absolute Difference %.....		0.4

Omega Temp Calibrator ID.....	<b>2</b>
Omega Temp Calibrator S/N.....	<b>T-293650</b>
Calibration Date.....	<b>8/13/2014</b>
Recert Date.....	<b>8/13/2015</b>



### DRY GAS METER AND PYROMETER POST-CALIBRATION DATA

Gas Meter ID.....	M5-19
Date.....	8/12/2015
Barometric Pressure (MBAR).....	844

Technician.....	DLM
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#### Reference Meter Calibration Data

	Run #1	Run #2	Run #3	Average
Yref	0.999	0.999	0.999	<b>0.999</b>
Yd	1.004	1.001	1.002	<b>1.002</b>
DH@	1.62	1.63	1.62	<b>1.63</b>
Calibration Results.....	<b>0.6%</b>			

M-5 box Pre Yd.....	1.008
Reference Meter ID.....	<b>2</b>
Reference Meter S/N.....	<b>6844262</b>
Reference Meter Yd.....	<b>0.999</b>
Calibration Date.....	<b>1/13/2015</b>
APT Recert Date.....	<b>1/13/2016</b>

#### Dry Gas Meter Calibration Data

Run #1	Delta H @ ("H <sub>2</sub> O)	Volume Meter (feet <sup>3</sup> )	Temp. In (°F)	Temp. Out (°F)	Volume Reference (feet <sup>3</sup> )	Temp. Ref. (°F)	Delta P ("H <sub>2</sub> O)	Vacuum ("Hg)	Time (min)
Start	1.5	721.174	70	69	764.419	68	0.91	13	10:18 AM
Stop	1.5	732.136	70	69	775.478	68	0.91	13	10:32 AM
Average	<b>1.5</b>	<b>10.962</b>	<b>70</b>	<b>69</b>	<b>11.059</b>	<b>68</b>	<b>0.91</b>	<b>13</b>	<b>14.0</b>

Run #2	Delta H @ ("H <sub>2</sub> O)	Volume Meter (feet <sup>3</sup> )	Temp. In (°F)	Temp. Out (°F)	Volume Reference (feet <sup>3</sup> )	Temp. Ref. (°F)	Delta P ("H <sub>2</sub> O)	Vacuum ("Hg)	Time (min)
Start	1.5	732.136	70	69	775.478	68	0.91	13	10:33 AM
Stop	1.5	758.004	71	70	801.515	69	0.9	13	11:06 AM
Average	<b>1.5</b>	<b>25.868</b>	<b>71</b>	<b>70</b>	<b>26.037</b>	<b>69</b>	<b>0.91</b>	<b>13</b>	<b>33.0</b>

Run #3	Delta H @ ("H <sub>2</sub> O)	Volume Meter (feet <sup>3</sup> )	Temp. In (°F)	Temp. Out (°F)	Volume Reference (feet <sup>3</sup> )	Temp. Ref. (°F)	Delta P ("H <sub>2</sub> O)	Vacuum ("Hg)	Time (min)
Start	1.5	758.004	71	70	801.515	69	0.90	13	11:07 AM
Stop	1.5	773.702	71	70	817.325	69	0.9	13	11:27 AM
Average	<b>1.5</b>	<b>15.698</b>	<b>71</b>	<b>70</b>	<b>15.810</b>	<b>69</b>	<b>0.90</b>	<b>13</b>	<b>20.0</b>

Pitot Leak Check	
0.00 @ 3" H <sub>2</sub> O Positive.....	x
0.00 @ 3" H <sub>2</sub> O Negative.....	x

System Response Check			
T/C Out (5).....	x	Pump In.....	x
Filter In.....	x	Aux In.....	x

Visual System Check	
Manometer Oil Levels.....	x
Physical Inspection.....	x

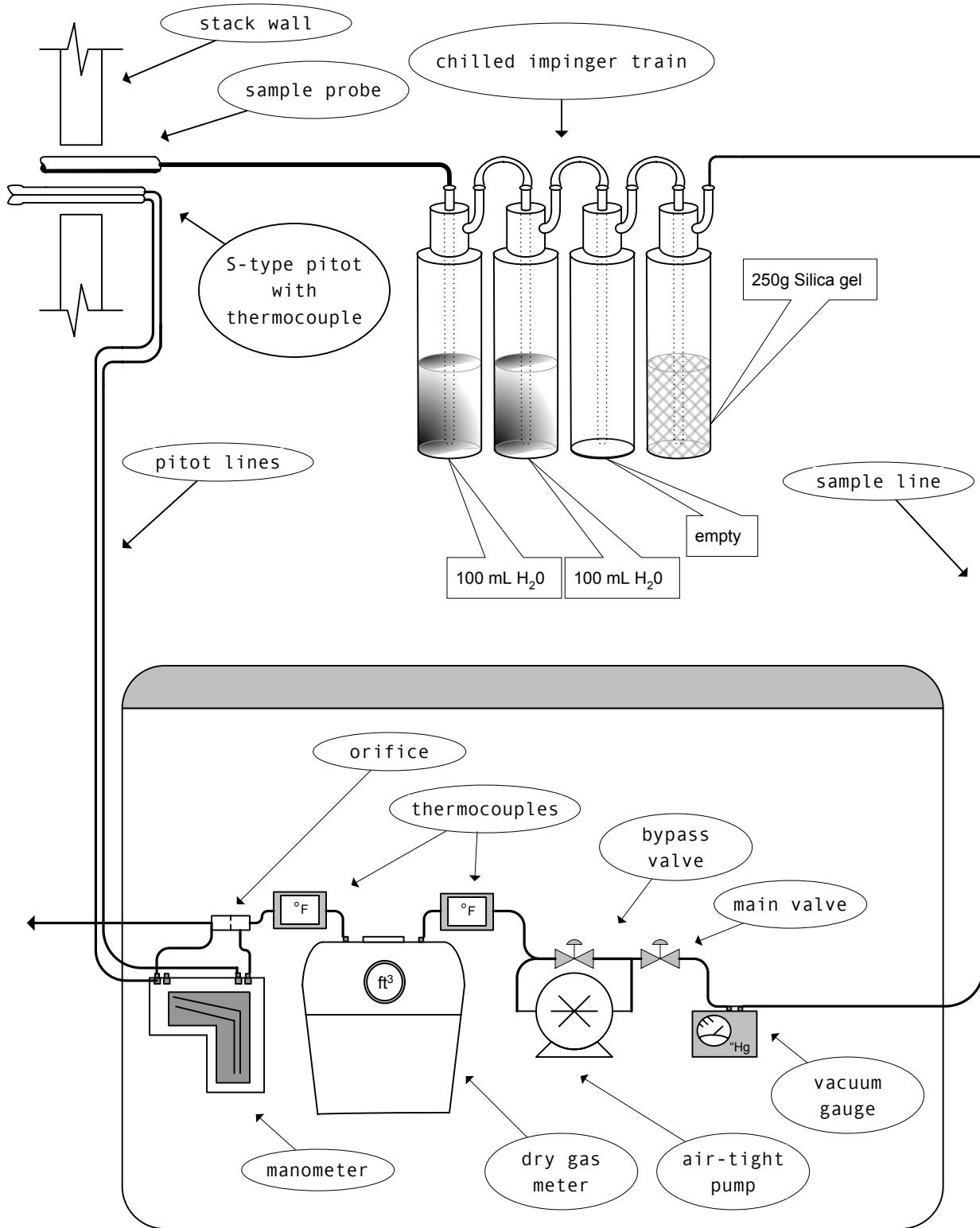
#### Pyrometer Calibration Data

Calibration Temp. Reading (F)	Pyrometer Reading (F)	ABS (Relative Difference) % R
0	-1	0.2
50	48	0.4
100	98	0.4
150	148	0.3
250	249	0.1
500	497	0.3
800	800	0.0
Max Absolute Difference %.....		0.4

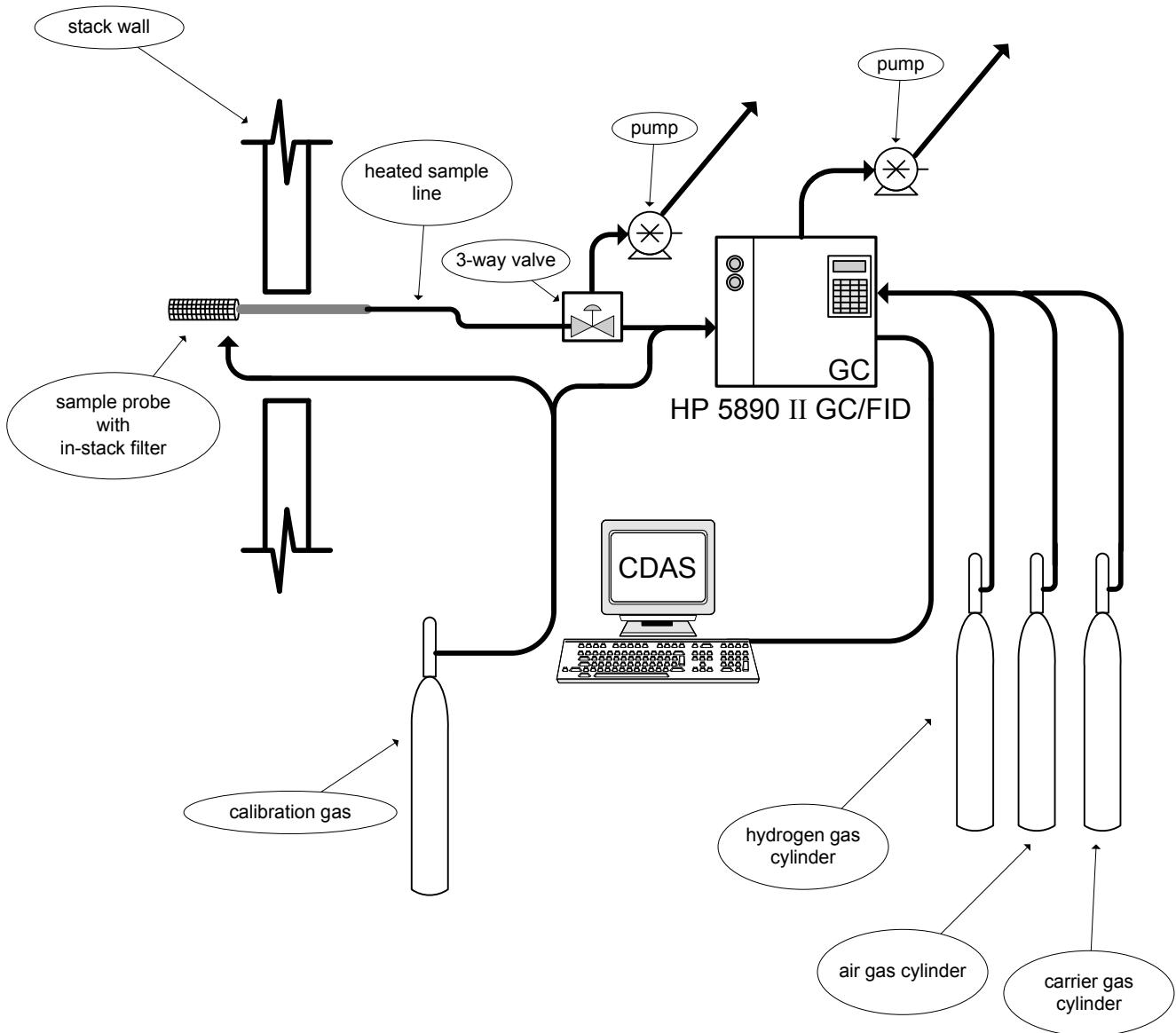
Omega Temp Calibrator ID.....	<b>1</b>
Omega Temp Calibrator S/N.....	T-197197
Calibration Date.....	7/7/2015
Recert Date.....	7/7/2016



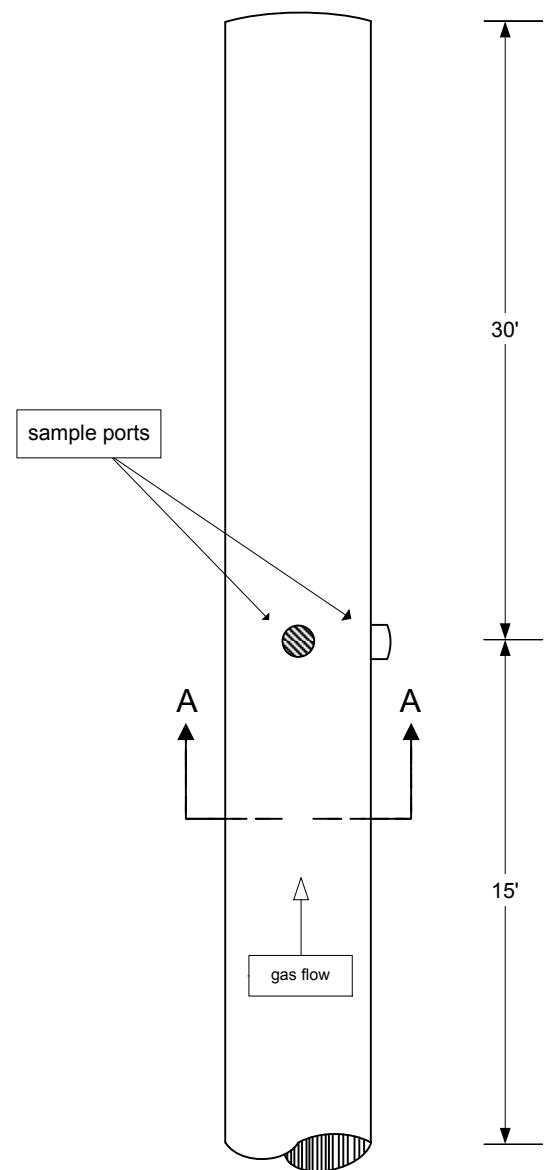
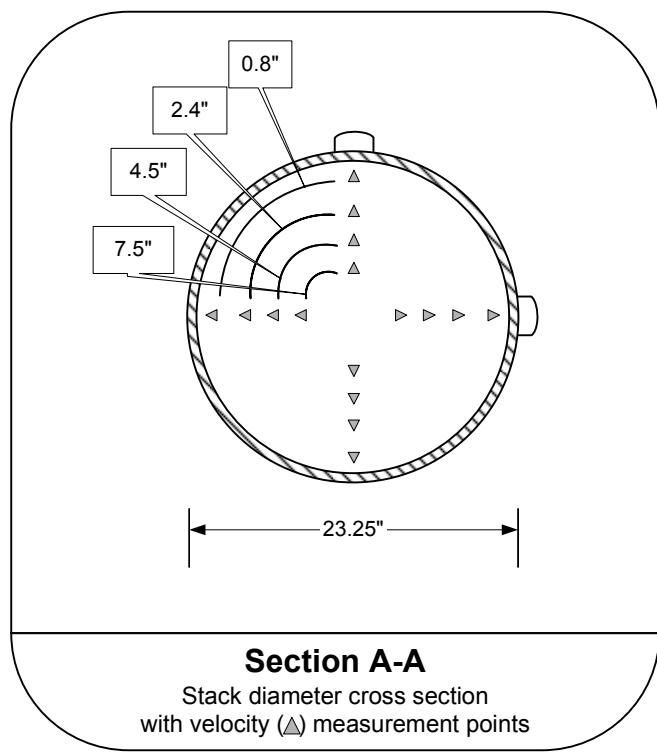
## Appendix Four: Schematics



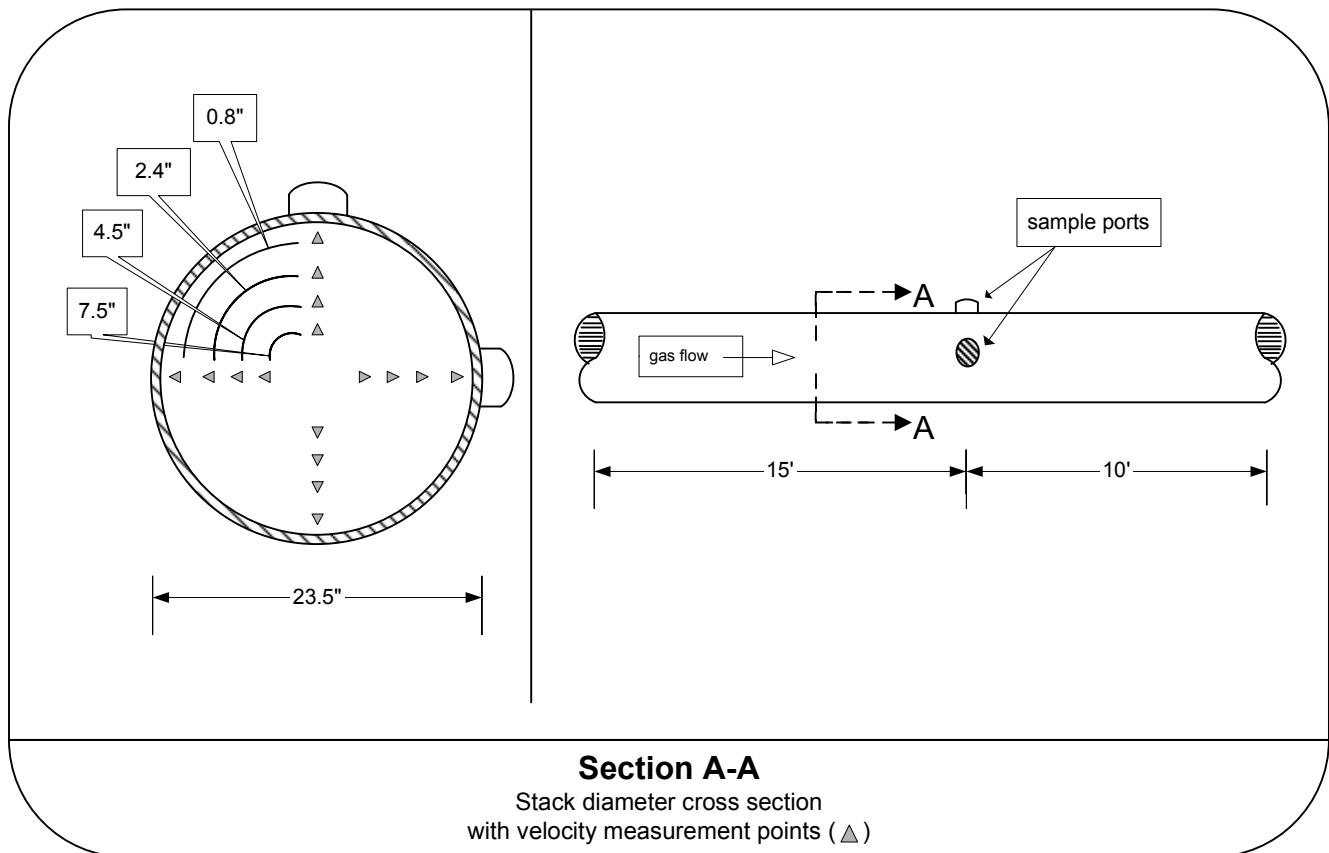
EPA Methods 1,2, & 4  
sampling train schematic



EPA Method 18  
sampling train schematic



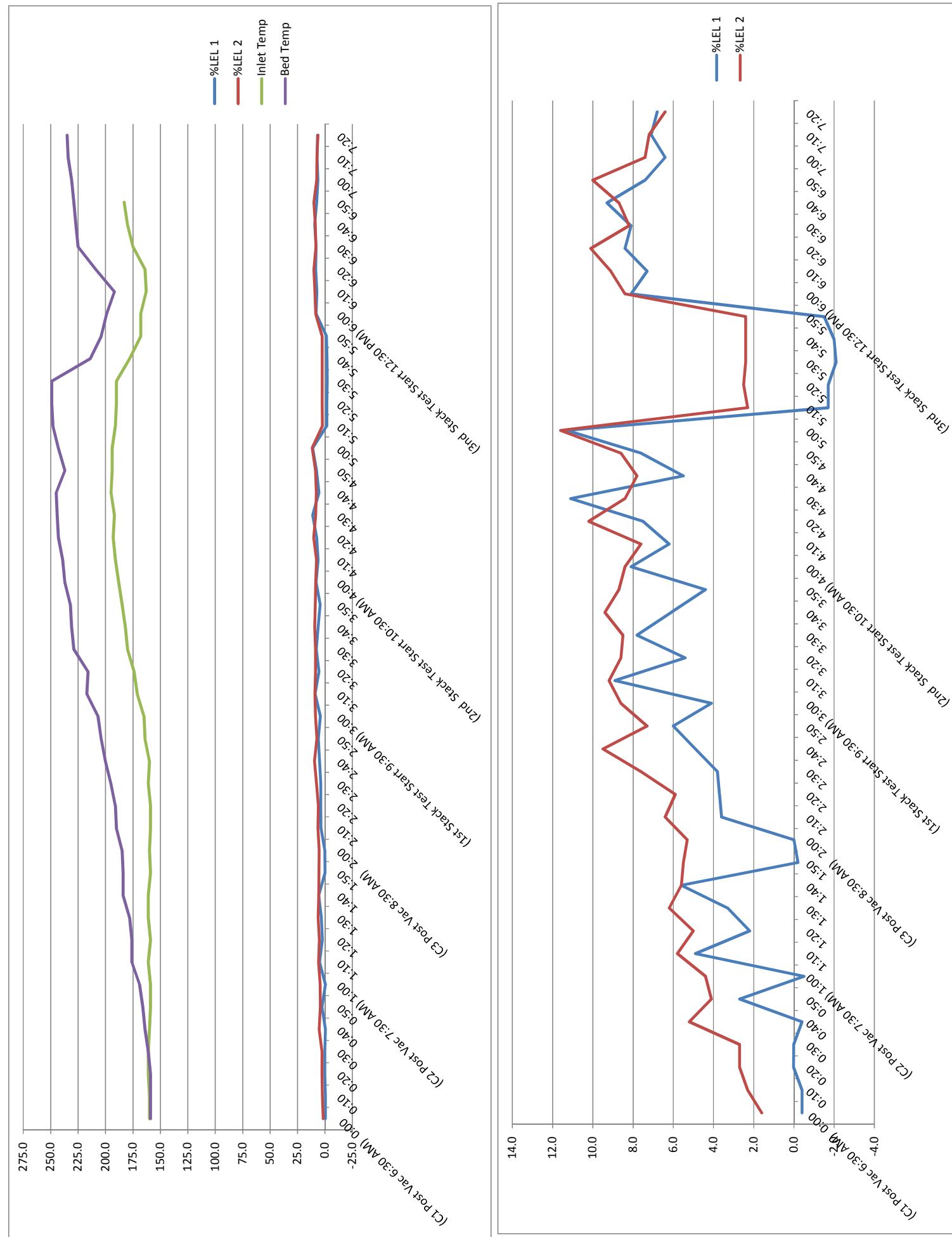
BD Medical - Columbus, Nebraska  
 Ethylene Oxide Sterilization Chamber - Catalytic Oxidizer (Outlet)  
 Stack Sampling Location Schematic  
 (not to scale)



BD Medical - Columbus, Nebraska  
 Ethylene Oxide Sterilization Chamber - Catalytic Oxidizer (Inlet)  
 Stack Sampling Location Schematic  
 (not to scale)



## Appendix Five: Operating Data



2015 Stack Test 7/31/2015						
Cycle Time	% LEEL	% LEEL	Inlet Bed Temp	Outlet Bed Temp	Clock Time	
(C1 Post Vac 6:30 AM) 0:00	-0.4	1.6	160	159	6:30 AM	
0:10	-0.4	2.3	160	159	6:40 AM	
0:20	0.0	2.7	161	159	6:50 AM	
0:30	0.0	2.7	161	161	7:00 AM	
0:40	-0.4	5.2	160	164	7:10 AM	
0:50	2.7	4.1	159	166	7:20 AM	
(C2 Post Vac 7:30 AM) 1:00	-0.5	4.4	159	169	7:30 AM	
1:10	4.9	5.8	161	176	7:40 AM	
1:20	2.2	5.0	159	176	7:50 AM	
1:30	3.3	6.2	161	178	8:00 AM	
1:40	5.6	5.6	161	184	8:10 AM	
1:50	-0.2	5.5	159	184	8:20 AM	
(C3 Post Vac 8:30 AM) 2:00	0.0	5.3	160	185	8:30 AM	
2:10	3.6	6.4	159	190	8:40 AM	
2:20	3.7	5.9	159	191	8:50 AM	
2:30	3.8	7.6	161	195	9:00 AM	
2:40	4.9	9.5	160	200	9:10 AM	
2:50	6.0	7.3	164	204	9:20 AM	
(1st Stack Test Start 9:30 AM) 3:00	4.1	8.6	165	207	9:30 AM	
3:10	8.9	9.2	171	217	9:40 AM	
3:20	5.4	8.6	174	216	9:50 AM	
3:30	7.8	8.5	180	229	10:00 AM	
3:40	6.1	9.4	182	231	10:10 AM	
3:50	4.4	8.7	185	232	10:20 AM	
(2nd Stack Test Start 10:30 AM) 4:00	8.1	8.4	188	237	10:30 AM	
4:10	6.2	7.6	191	239	10:40 AM	
4:20	7.5	10.2	193	243	10:50 AM	
4:30	11.1	8.4	192	244	11:00 AM	
4:40	5.5	7.8	195	245	11:10 AM	
4:50	7.6	8.6	194	237	11:20 AM	
5:00	11.3	11.6	194	243	11:30 AM	
5:10	-1.7	2.3	191	248	11:40 AM	
5:20	-1.7	2.5	190	249	11:50 AM	
5:30	-2.1	2.4	190	249	12:00 PM	
5:40	-2.0	2.4	178	214	12:10 PM	
5:50	-1.5	2.4	168	204	12:20 PM	
(3rd Stack Test Start 12:30 PM) 6:00	8.1	8.4	168	199	12:30 PM	
6:10	7.3	9.1	163	192	12:40 PM	
6:20	8.4	10.1	164	209	12:50 PM	
6:30	8.1	8.2	175	225	1:00 PM	
6:40	9.3	8.7	180	227	1:10 PM	
6:50	7.4	10.0	183	229	1:20 PM	
7:00	6.4	7.4	185	231	1:30 PM	
7:10	7.1	7.2	187	234	1:40 PM	
7:20	6.8	6.4	188	235	1:50 PM	

Convert %LEL to ppm  
30000 = LEL  
5% LEL = .05 x 30000 = 1500 ppm